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The Personnel Journal

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The Science of Work, the Human Factor in Management and the Satisfactory Adjustment of Individuals to Their Occupations

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THE PERSONNEL JOURNAL publishes original investigations in the applied sciences that contribute to knowledge and effective direction of people at work.

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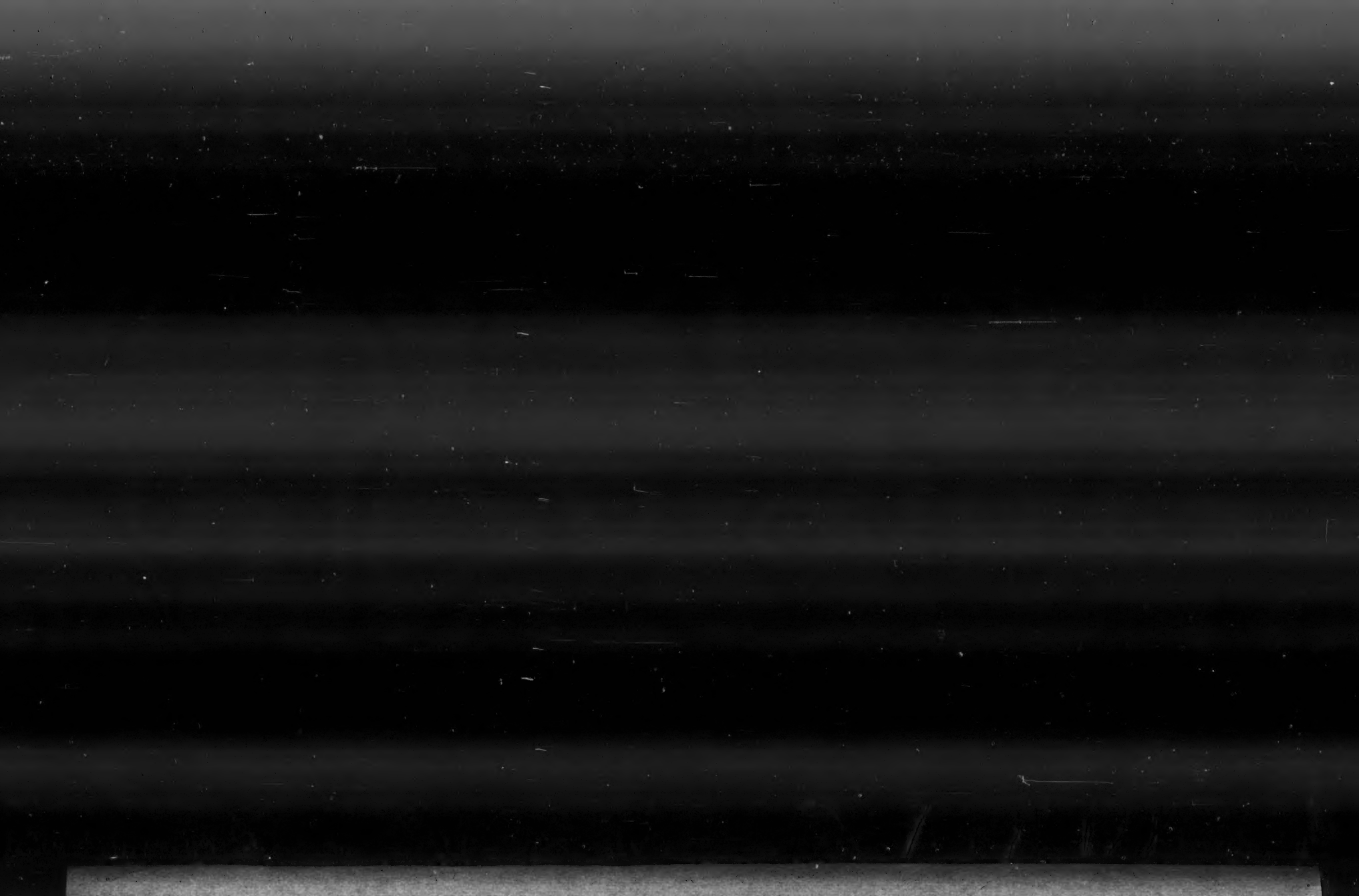

Color Blindness in Dry Goods Salesmen

By W. R. Miles and Homer Craig, Jr., *Stanford University*

Many a personal peculiarity may become either an occupational liability or an asset. Color blindness in necktie salesmen is an instance in point. But if such a trait is to be an asset, it must be known and properly dealt with by the employment manager. In the San Francisco stores, where Professor Miles and Mr. Craig made their survey of 375 salesmen who were selling colored goods, they found 27 whose color vision was definitely defective. Evidently the Ishihara test for color blindness should be on the desk of every employment interviewer in department stores.

A young man who proved color-blind claimed that he had worked with success as a salesman in a men's clothing store and that he had gained an enviable reputation for being able to select ties to match men's suits. This interesting case suggested that color-blindness might possibly have a particular place or service to fulfill in industry. Brightness matching is secondary to chroma matching, but if well done makes the matched combination perfect.

In San Francisco and vicinity 375 dry goods salesmen were tested individually for color-blindness by means of the Ishihara plates. No women were tested. The examinations revealed 27 well-marked cases of color-blindness who were actually selling colored materials. The percentage of salesmen found to have note-worthy color defect is therefore 7.2, which is only slightly less than that found among university students. From this it appears that the occupation of selling colored materials *may* automatically exclude the three or four worst cases (most nearly completely color-blind individuals) who occur in a population of three or four hundred. But every department, with the possible exception of silk counters, had its quota of color-blind salesmen. From follow-up studies it is very evident that many of these salesmen constitute a liability to the concerns for which they work. The authors strongly recommend that the Ishihara test be regularly used in personnel departments of mercantile establishments for examining people who apply for positions. No case was discovered where color-blindness was being constantly used as an asset in the occupation.

A LARGE number of color-blind men, perhaps about fifty per cent, are quite unaware that they have actual defect in color vision. A typical self-description from their group is given by the following verbatim quotation: "I am not very good at colors because I never thoroughly learned their names. Some day I plan to take a little time and get up

on the subject." The Ishihara Test (1) constitutes the simplest available demonstration for convincing such cases that it isn't just a matter of taking "a little time," and often the test calls forth very interesting comments. One young man in a student group tested at Stanford University in 1927 said, when informed of the results which showed a profound defect, "It is quite impossible that I should be color-blind! I have worked a great deal in men's clothing stores and in fact in one large store was considered the best person for selecting ties to match suits. How could I possibly do this if I have any color defects?" The question was a very pertinent one as there was no doubt of his grave color-blindness. Rather than dispute the matter the investigator invited this man to stand at the side and watch several other students go through the test. To his absolute astonishment these promptly, one after another, read numbers from plates that to him were entirely blank. He was convinced by this practical demonstration that his vision differed from that of the many, that he was, unbelievable as it had seemed, color-blind.

INCEPTION OF STUDY

It occurred to us that this man when in the rôle of a clothing salesman perhaps selected the neckties on the basis of brightness. He probably pulled several from the tie-racks, saying to the customer, "Any one of these ties would go well with your suit." The customer, with perhaps sometimes the help of another salesman, both probably having normal color vision, then selected the best chroma combination from the group of ties any one of which had the proper brightness value. Color-blindness in such a case might actually be operating as an asset, aiding the salesman in achieving a result better than could ordinarily be got by those with full color sensitivity.

Taking our cue from this case, we asked ourselves if it could be possible that industry has special places of usefulness for color-blind individuals. Perhaps every well-organized haberdashery should have its one or two high salaried color-blind employees to use generally throughout the store in matching brightnesses where the chromatic elements are so strong as to make this difficult for the ordinary person. Brightness matching is secondary to chroma matching, but it is just the additional part that when well done makes the combination perfect. If the color-blind salesman did not realize his own limitations and work within his own ability the natural supposition is that he might repeatedly have goods returned, become discouraged and finally be discharged for no other reason than this, that he was not able to perceive a distinct subjective difference between red and green. Is industry selecting or eliminating these people? The problem seems to have both practical and theoretical importance. It has prompted us to carry through a series of color vision tests on individuals employed to sell merchandise where color is a prominent factor, namely in retail dry-goods stores.

TEST PROCEDURE

Superintendents and employment managers of several leading stores of

the San Francisco Bay region were approached and practically without exception these officials expressed willingness to coöperate in our study. We arranged to conduct the tests for each group of salesmen within the store in question. In each case a place was picked out where the examination could be made with adequate natural light, and with suitable seclusion so that one person could be examined alone without observation or comments from his associates. The original contact having been made through the superintendent or personnel department, the examination was usually arranged through the training bureau, which, in each case, gave excellent cooperation. A program was drawn up with the names of the men to be examined and with a regular time schedule of appointments. Because the defect of color-blindness is practically confined to men, men only were studied and these were chosen without discrimination from each department which had to do with the selling of color and color combinations. Typical examples of the departments included for study are men's clothing, draperies, furniture, wash and dress goods, and rugs. The managers of each department were told that a test was being conducted, and they were requested to send their men salesmen, in whatever relays they wished, to the testing headquarters which had been established in that store. Each man tested was told that the purpose of the test was to compare the performances of different ages and different occupations. It was not stated that this was a color-blindness test. Each individual was assured that the results of his performance would not be reported to anyone in the store or connected with his employers and that his participation was simply a matter of coöperation in a scientific research. All of the men responded with ready coöperation.

The Ishihara Test[1] was used in all of the examinations according to what we call the full-display method. The color plates, or charts, in their usual mounting on the folded strip, were stretched out in one horizontal line and attached to the wall at a height of about five feet. Chalk lines parallel to the plates were made on the floor, one at four feet, and the other at ten feet from the vertical plane supporting the test. The men were admitted to the room one at a time and were tested binocularly. They passed along the four-foot line parallel to the plates, reading off the numbers and tracing the lines wherever requested so that the thirteen plates were read consecutively and in the same order. In each case the subject was squarely in front of the number to be read and at first about four feet from it. If in reading the entire series, which normally takes less than two minutes, he made no mistakes, or *one* mistake only, he was judged normal and no further testing was done. If he made several mistakes he was started again at the first of the series and a written account was made of his responses as he went along. The name and the department of each man reported in detail was added to the account of his performance.

[1] This color-blindness test is based on the fact that red and green numbers printed in dots on green and red and tan backgrounds of dots can not be seen by the red-green blind.

On the mounting above each of the thirteen plates was a white number about one-half inch high and the plates were labelled 1 to 13 by these in a series from left to right.[2] These small numbers in addition to designating the separate plates for the use of the examiner facilitated giving directions and questioning the men. They aided also as tests for discovery of eye defects that required different reading distances.

After the color vision test numbers, $1\frac{3}{4}$ to $2\frac{1}{4}$ inches high, had been read at the four-foot distance, each color-blind man tested went to the ten-foot mark and read the complete series (of plates) again. Before testing him at ten-foot distance we said, "Some people can read the numbers better if they stand off farther." All of the subjects seemed interested in the examination and they expressed themselves as quite willing to try at any distance, or any number of times desired. Following the ten-foot trial the subject stood again at four feet or nearer and was now asked to name the colors of some of the individual dots as pointed to.

The men who gave evidence of noticeable color defect were asked about the character of their duties in the departments in which they were working, and an effort was later made to observe in the department the actual amount of color dealt with in each case. The salesman was directly questioned in this later interview about the colors of various materials on his counter and shelves and records were taken of his responses for solid colors, mixtures and patterns. He was then questioned on his experience, the various positions he had held, whether or not he had formerly dealt with more color, and finally as to any known color difficulty in his family or among his forebears. After this his statements were verified as far as possible, through discussion of the matter with department managers and his direct associates. In each case, an effort was made to determine the individual's status in the store; his record of returned goods from dissatisfied customers; what positions he had held prior to coming here; former positions held in this store; and his length of service in various occupations and positions.

The information received from the men themselves and from their store organizations was not satisfactory. In some cases it was untrustworthy, in others, too fragmentary. As might be expected, after having discovered that they had color defect, the majority of the men examined were somewhat reticent. They were not anxious to go into much detail about themselves and their color-blind experiences. Of course they could not but think that these remarks might endanger their positions. Information from the personnel bureaus was not very clear or complete. None of them maintained very accurate information on their employees of the type we desired. There was no record of the number of cases or sales value of returned goods sent back on account of wrong color, and no direct classification as to the comparable abilities of the various men, except so-called cost records which are

[2] These same numbers in extremely small type are printed on the white margin of the plates, and the same numbers are used in the fore-part of the test manual under "Explanation."

contributed to by many outside elements [3]

RESULTS AND COMPARISONS

Individual tests were made of 375 salesmen. One store provided 73 cases, another 53, another 47, and so on. We believe our sample population is fairly representative of salesmen dealing with colored fabrics used for clothing or house decorations. It was evident from the first that there were plenty of color-blind people to be found in this occupation. The complete canvass revealed a total of 27 well-marked cases who were actually doing the selling of colored materials. In order to be numbered among the color-blind of this group an individual had to fail

TABLE 1

Individual results for the 27 color-blind men discovered in a total group of 375 dry-goods salesmen working in and about San Francisco in 1929

MEN	ISHIHARA CHARTS BY NUMBER									
	2	3	4	5	6	7	8	9	12	13
(Normal)	(8)	(6)	(5)	(74)	(2)	(6)	(5)	(7)	(26)	(42)
Color-blind										
1	8	5	5	21	6	2	5	7	25	42
2	—	—	—	17	—	—	—	—	2–	4–
3	—	—	—	—	2	6	5	7	20	42
4	8	6	5	21	2	6	3	9	28	42
5	3	5	2	21	—	—	—	—	2–	4–
6	5	6	2	21	2	6	8	9	23	48
7	3	5	2	21	2	—	—	7	2–	4–
8	8	6	2	—	—	—	—	—	—	—
9	5	5	2	21	—	—	—	—	—	—
10	—	—	—	—	—	6	—	—	2–	4–
11	8	6	2	21	2	6	5	7	2–	4–
12	3	6	2	21	2	6	—	—	26	42
13	—	—	2	—	—	—	6	7	-8	4–
14	8	6	5	—	2	6	5	9	26	42
15	8	3	2	21	—	—	—	—	4	—
16	—	7	—	11	—	—	5	9	2–	4–
17	8	6	2	24	2	6	5	7	26	42
18	—	—	—	—	—	6	5	—	2–	4–
19	3	5	2	21	—	—	—	—	—	4–
20	8	6	5	71	2	6	5	9	26	42
21	—	—	2	21	—	6	—	—	2–	4–
22	3	2	2	21	—	8	8	9	28	4–
23	8	6	2	21	—	—	—	—	—	—
24	—	—	5	—	2	6	5	9	25	42
25	—	—	—	—	2	6	—	—	2–	4–
26	3	5	2	21	—	—	—	—	2–	4–
27	3	5	—	21	2	—	5	9	26	42

[3] The tests and follow-ups were all made by Homer Craig, Jr., in the spring and early summer of 1929.

on two or more of the plates. This is the same criterion which had been used in a former study (2). The percentage of our salesmen group found to have noteworthy color defect is 7.2, while the former study of 1286 Stanford men examined individually in the above the responses of the color-blind men. The latter are designated by numbers from 1 to 27. In the response columns a dash indicates complete failure to see the number on that particular plate. Apparently no man of the 27 was completely color-blind, but

TABLE 2

Responses of color-blind salesmen on the various Ishihara plates

Total number of salesmen examined 375; color-blind 27; per cent 7.2

PLATE NUMBER	NORMALS READ	USUAL COLOR-BLIND READ	READ CORRECTLY		READ AS USUAL FOR COLOR-BLIND[1]		MISCELLANEOUS READINGS		UNABLE TO SEE TEST NUMBERS	
			Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
1	12	12	27	100	27	100	0	0	0	0
2	8	3	9	33	7	26	2	7	9	33
3	6	5	9	33	7	26	3	11	8	30
4	5	2	5	19	15	56	0	0	7	26
5	74	21	0	0	15	56	4	15	8	30
6	2	—	12	44	14	52	1	4	14	52
7	6	—	13	48	12	44	2	7	12	44
8	5	—	10	37	13	48	4	15	13	48
9	7	—	6	22	13	48	8[2]	30	13	48
10	—	(5)								
11	—	(2)								
12	26	2 or 6	5	19	2–21	78	6[3]	22	4	15
					6–5	19				
13	42	4 or 2	9	33	4–23	85	1[4]	4	4	15
					2–9	33				

[1] Number of readings that correspond to the third column from the left.

[2] These 8 read the plate as 9, which is easily mistaken from 7.

[3] There were 2 others who read it as a single number not 2 or 6; 10 read it as 2 only; 0 read it as 6 only.

[4] There were 0 others who read it as a single number not 4 or 2; 13 read it as 4 only; 0 read it as 2 only.

At a distance of 10 feet, 6 men showed more accurate readings; 10 showed no improvement; 10 showed less accurate readings (1 was not recorded).

same manner had revealed 106 cases, that is, 8.2 per cent.

The individual results for the salesmen who were found to be color-blind are presented in table 1, which gives their responses on each of the thirteen Ishihara plates. The normal readings for the plates are given in parenthesis Subjects 2, 8, 9, 15, 19, and 23 certainly gave evidence of very grave color defect. On the results from plates 12 and 13 it seems that Subjects 8, 9, 15, and 23 should be classified as completely red-green blind. Cases that read only the number 2 on plate 12 and only 4 on plate 13 are said to

be green-blind, a condition strongly predominating in our group. Plate 5 is certainly the most sensitive indicator of color weakness that we possess. Nobody in the color-blind group read it in the "normal" way, i.e., as 74. The great majority called it 21, which it usually is to the color-weak or color-blind. It should be said that we found six other salesmen, in addition to the 27, who failed on this plate, one of these read it as 24, but the other five said "21." These men do not have quite normal color vision but as they made no other mistakes we did not count them color-blind.

In table 2 the results on the different plates are grouped and percentages are shown. Normal and color-blind read the first plate correctly, giving the response "12." But plate 2, which has a green background and is read by normals as "8," is ordinarily seen by color-blind as "3," because they do not see a certain section of dots which completes the 3 into 8. The table shows that 9 of the 27 color-blind, 33 per cent, read it correctly, (i.e., they saw the 8) 7, or 26 per cent, read it as "3," 2 gave some miscellaneous readings, and 9, one-third of the group, were unable to see any numeral on the plate. Plate 3 gave similar results. Five of the 27 color-blind correctly read plate 4, 15 read it in the characteristic manner of the color-blind, that is as "2," there were no miscellaneous responses, and 7 men were unable to see a number on the plate. Plate 5 also has a double interpretation. It is read normally as 74, but by the color-blind usually as 21. Fifteen gave the characteristic response of 21, 4 gave miscellaneous responses and 8 were unable to see any number. Plates 6 and 7 each have one red number on a green field, while 8 and 9 have green numbers on backgrounds made of red-colored dots. There are no hidden numbers on these four plates and hence the color-blind very frequently fail to see anything on them. For these plates we therefore repeat in the column, "Read as is usual for color-blind," the values given in the final column under the caption, "Unable to see numbers." We note here that practically 50 per cent of the group declare themselves wholly unable to see any numeral on these four plates.

The best comparison material we can provide for these results on the salesmen is available in the data secured in three consecutive years on entering men at Stanford University examined under similar conditions with the same test material. These results are given in table 3, parts I, II, and III. Parts I and II represent a tabulation for two years separately of 106 cases of color-blindness found in a survey of 1286 Stanford men and reported in one group in a former article (2). Part III is a tabulation of similar data not previously reported. Part I gives the data for 1927. The number of men examined was 590; number of color-blind located, 48; per cent, 8.1; part II is for 1928; number examined, 696; color-blind, 58; per cent, 8.3; part III reports 1929; number examined, 554; color-blind, 49; per cent, 8.8. Table 3 (students) is arranged in exactly the same manner as table 1 (salesmen), and in general the two tables show agreement. But we must make a close analysis to discover if possible any differences between color-blind sales-

men and color-blind university students. Our best opportunities for comparison are in the percentage columns. For example, in the column headed, "Read as is usual for color-blind," we note that for plates 2 to 9 inclusive the percentages range from 26 to 56 for salesmen while in the comparable sections of table 3 the percentages for the students range from 40 to 85. Again it is noteworthy that a relatively large percentage of the salesmen read plates 6, 7, 8, and 9 correctly. In order to simplify the

TABLE 3

Responses of color-blind university men on the various Ishihara plates

PLATE NUMBER	NORMALS READ	USUAL COLOR-BLIND READ	READ CORRECTLY		READ AS USUAL FOR COLOR-BLIND[1]		MISCELLANEOUS READINGS		UNABLE TO SEE TEST NUMBERS	
			Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Part I, 1927, number examined 590; color-blind 48; per cent 8.1										
1	12	12	48	100	48	100	0	0	0	0
2	8	3	21	44	19	40	6	13	2	4
3	6	5	20	42	23	48	4	8	1	2
4	5	2	8	17	36	75	2	4	2	4
5	74	21	6	13	35	73	3	6	4	8
6	2	—	4	8	32	67	12[2]	25	32	67
7	6	—	10	21	35	73	3	6	35	73
8	5	—	0	0	38	79	10	21	38	79
9	7	—	2	4	40	83	6[3]	13	40	83
10	—	(5)								
11	—	(2)								
12	26	2 or 6	9	19	2–36	75	8[4]	17	9	19
					6–12	25				
13	42	4 or 2	14	29	4–35	73	3[5]	6	9	19
					2–17	35				
Part II, 1928, number examined 696; color-blind 58; per cent 8.3										
1	12	12	58	100	58	100	0	0	0	0
2	8	3	34	59	20	35	3	5	1	2
3	6	5	21	36	29	50	8	14	0	0
4	5	2	2	3	54	93	2	3	0	0
5	74	21	1	2	48	83	7	12	2	3
6	2	—	10	17	39	67	9[6]	16	39	67
7	6	—	12	21	39	67	7	12	39	67
8	5	—	3	5	49	85	6	10	49	85
9	7	—	5	9	46	79	7[7]	12	46	79
10	—	(5)								
11	—	(2)								
12	26	2 or 6	5	9	2–41	71	7[8]	12	4	7
					6–11	19				
13	42	4 or 2	10	17	4–41	71	2[9]	3	4	7
					2–20	34				

TABLE 3—*Concluded*

PLATE NUMBER	NORMALS READ	USUAL COLOR-BLIND READ	READ CORRECTLY		READ AS USUAL FOR COLOR-BLIND[1]		MISCELLANEOUS READINGS		UNABLE TO SEE TEST NUMBERS	
			Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Part III, 1929, number examined 554; color-blind 49; per cent 8.8										
1	12	12	49	100	49	100	0	0	0	0
2	8	3	21	43	22	45	5	10	1	2
3	6	5	18	37	29	59	2	4	0	0
4	5	2	2	4	41	84	4	8	2	4
5	74	21	0	0	41	84	3	6	5	10
6	2	—	13	27	26	53	10[10]	20	26	53
7	6	—	18	37	25	51	6	12	25	51
8	5	—	8	16	32	65	9	18	32	65
9	7	—	12	25	33	67	4	8	33	67
10	—	(5)								
11	—	(2)								
12	26	2 or 6	6	12	2–37	76	14[12]	29	10	20
					6–7	14				
13	42	4 or 2	14	29	4–36	74	4[13]	8	8	16
					2–17	35				

[1] Number of readings that correspond to the third column from the left.

[2] Of these, 9 read the plate as 8, which is fairly easy to confuse with 2.

[3] Of these, 5 read the plate as 9, which is easily mistaken from 7.

[4] There were 0 others who read it as a single number not 2 or 6; 19 read it as 2 only; 3 read it as 6 only.

[5] There were 2 others who read it as a single number not 4 or 2; 18 read it as 4 only; 3 read it as 2 only.

[6] Of these, 6 read the plate as 8.

[7] Of these, 6 read the plate as 9.

[8] There were 7 others who read it as a single number not 2 or 6; 29 read it as 2 only; 6 read it as 6 only.

[9] There was 1 other who read it as a single number not 4 or 2; 31 read it as 4 only; 9 read it as 2 only.

[10] Of these, 5 read the plate as 8.

[11] Of these, 3 read the plate as 9.

[12] There was 1 other who read it as a single number not 2 or 6; 17 read it as 2 only; 1 read it as 6 only.

[13] There was 1 other who read it as a single number not 4 or 2; 19 read it as 4 only; 3 read it as 2 only.

comparisons we have derived the two short tables 4 and 5. In table 4 we have grouped the results for plates 2, 3, 6, and 7 in all of which red numbers are presented on green backgrounds. Under the captions, "Read correctly," "Read as is usual for color-blind," and "Unable to see numbers" we have taken the percentages directly from table 2 for the salesmen and have averaged the per cents found in the three parts of table 3 for the students. It will be seen in table 4 that salesmen do much more poorly than students with plates

2 and 3; fewer of them read the test numbers correctly (as normal people read them), fewer show the typical color-blind result, and many more (10 times as many) fail to make out any numbers at all. Table 5 shows practically the same state of affairs for plates 4 and 5 with a single exception: 19 per cent of the salesmen read plate 4 correctly as compared to 8 per cent of students. When we consider plates 6 and 7 in table 4, and 8 and 9 in table 5, we find our comparisons just reversed. Here more color-blind salesmen than students (twice or three times as many) read the plates correctly and decidedly fewer salesmen fail entirely to see the test numbers. At first sight this seems a direct contradiction between the two groups and we sought some difference in type of color-blindness that might account for it. Turning to plates 12 and 13, which possess the unique advantage of classifying subjects as red-blind or green-blind, we found very substantial agreement between the two groups. Salesmen and students both show a strong predominance of green blindness, in the ratio of 3 cases to 1 of red blindness. The contrast in results for the other plates appears now to rest on two considerations. Plates 2 to 5 inclusive all contain hidden numbers and each numeral is made up or interwoven with more than one color. This complication makes these charts difficult material even for those with normal

TABLE 4

Comparison of color-blind salesmen and color-blind university students in their reading of red numbers on green backgrounds (values in per cent)

RESPONSES	ISHIHARA CHART NUMBERS							
	2		3		6		7	
	Salesmen	Students	Salesmen	Students	Salesmen	Students	Salesmen	Students
Read correctly	33	49	33	38	44	17	48	26
Read as is usual for color-blind	26	40	26	52	(52)	(62)	(44)	(64)
Unable to see number	33	3	30	1	52	62	44	64

TABLE 5

Comparison of color-blind salesmen and color-blind university men in their reading of green numerals on red backgrounds (values in per cent)

RESPONSES	ISHIHARA CHART NUMBERS							
	4		5		8		9	
	Salesmen	Students	Salesmen	Students	Salesmen	Students	Salesmen	Students
Read correctly	19	8	0	5	37	7	22	13
Read as is usual for color-blind	56	84	56	80	(48)	(76)	(48)	(76)
Unable to see numbers	26	3	30	7	48	76	48	76

vision. It is relatively easy even for individuals without defect to see the centers of these four charts as complicated color blurs, whereas in plates 6 to 9 inclusive the numerals are in one color only and therefore fairly clear. The older men (salesmen) were bothered more by the complicated figures, while with the simpler plates their longer experience and perhaps more persistent attention to colors enabled them to do somewhat better than the students.[4]

If we consider the average incidence of color-blindness in university men to be about 8.4 per cent, the salesmen with their incidence of 7.2 per cent in the population examined are demonstrating a frequency which equals only 86 per cent of that found in the younger group. Had we found 31 cases in place of 27 our salesmen's results would have been just at the average level of incidence. Perhaps it is not impossible that in a group of 375 men 3 or 4 severe cases of color-blindness have been eliminated from the industry by the process of natural selection, but we cannot be certain of this at present. The difference, 1.2 per cent (i.e., 8.4 minus 7.2) is not a statistically reliable difference with groups of the size reported. The standard deviation of this difference is 1.49, and the difference is therefore only 0.81 times its S.D. With groups of the size of ours the difference would have to be at least 4.5 per cent to qualify as of probable statistical significance according to the usual criterion in such measurements. The differences recently published by Clement (3) in a comparison of races with respect to color-blindness seem to satisfy the statistical criterion of validity. The variations between the three subgroups of table 3 cover a total range of 0.7 per cent, which is about one-half the size of the difference between salesmen and students. We have therefore just a slight hint and no more that color-blindness in dry-goods salesmen may be a little less than in the general population. Examination of additional cases should indicate whether or not the smaller percentage value found in our particular group of salesmen is typical of their occupational class.

[4] It may be that color-blindness changes somewhat with age. We do not know of any other results on this point.

DISCUSSION

Our testing of 375 dry-goods salesmen indicates that this occupation does not on the one hand draw to itself color-blind individuals nor does it rid itself particularly of the color-blind men whom it chances to draw. There were six of the color-blind salesmen who, although unable to read the numbers, could nevertheless give the color of any dots to which the examiner pointed. In other words, they had no trouble whatsoever with solid colors. Four of the men improved their readings at the ten-foot distance, indicating that they have greater color sensitivity at the center of the fovea, an equipment which is, of course, sufficient for most ordinary uses.

There was no instance found where salesmen had obviously benefited by being color-blind, or where color-blindness was consciously being used as an asset to the individual or the occupation. One man who had very definite red-green blindness was still able to

make excellent color combinations and had formerly been a "color expert," to use his own words. He claimed to have acquired color-blindness and so no longer to be able to detect color mixtures which he had formerly recognized. Of the entire list of subjects, 15 cases of the more pronounced type, men who were constantly selling colored goods and either failed to tell color mixtures or color solids with any degree of accuracy, were selected for examination as to occupational performance. From a survey of their activities it seems evident that as a group they were a liability in their present placements to the firms represented. Undoubtedly they should have been used in some other departments or lines. On careful examination it was found that each of these men made frequent mistakes such as would cause embarrassment to customers and to the firm, and serious errors unless some other salesman was called upon to assist in difficult combinations or sales. Many of these men found it necessary to place various colored pieces of goods on definite shelves so that when customers called for a certain color they would know where to find it, in terms of space rather than by direct visual perception. In one case it was found that the color-blind salesman's returned goods aggregated a much larger amount than was recorded for any other man in that department. The store explained the fact by saying that this salesman was known as a "forcer of sales." The average salesman endeavors to give just the right word that will make the customer think the object in question well suited to the need. The color-blind salesman cannot always render the wise verdict that should clinch a sale. He must resort to some special phrases such as, "Now I suggest that you take this home and see it under the conditions of lighting that you have. Then you will be able finally to decide. If it isn't all right of course you can bring it back." In such a case the customer may himself be a bit doubtful, but goes away with the materials and, unfortunately, in a large number of cases, returns them later. Our explanation here is of course based to a considerable extent on speculation. It was impossible to follow up cases in terms of store records sufficiently well classified to give clear quantitative evidence on this point.

The silk counter seems to have its own way of scaring off color-blind salesmen, but no other color-dispensing counter or department is immune from them. To the actual defect is added the fact that color-blind salesmen are usually not fully aware of their own difficulties, do not often know how to avoid errors on this account, and, furthermore, their associates, who of course do not understand, criticize readily and unfairly.

As a result of our investigation it seems safe to say that one-half of the color-blind individuals who are attempting to sell color are something of a detriment to their respective firms. In the interests of business efficiency and of personal accomplishment these people should be transferred to other departments. The Ishihara Test is such a convenient tool for sorting people in this regard that there is every reason to recommend it strongly for use in personnel departments of mer-

cantile establishments. The employment manager or whoever holds the original interview with the applicant might have Ishihara plate 5 on his desk. This would indicate sufficiently in just a moment's time whether the individual is normal in color vision.[5] If he does not succeed in this simple test it is quite probable that he is color-blind. Further tests should be made in such cases. If the color-weak or color-blind condition is found when the man is first employed, perfect occupational adjustment so far as this point is concerned can be readily achieved in most industries.

Our original question as to possible special values of color-blindness in industry is still unanswered. We discovered one man who had perfectly normal color sense in one eye and marked color-blindness in the other. He knew the state of affairs and used his eyes accordingly. This would be an ideal combination if the notion that brightness matching can be done best by the color-blind is sound. Managers who find themselves blessed with one or two color-blind salesmen of superior intelligence might experiment in this field, proceeding with the full recognition of the situation and depending on the combined effort of the color-blind salesman or "expert," the customer, and the associate salesman of normal vision. It seems likely that the careful color-blind eye has a contribution to make if we knew just when and how to use it.

[5] The applicant could of course be coached to say "74." But if the examiner has doubts he may easily make further requests such as: "Point to the dot on the extreme left of the 7," "What dots are inclosed by the 4," etc.

SUMMARY

1. Color-blindness is almost if not quite as common among dry-goods salesmen as in the general population of young men. From testing 375 clerks individually it was found that 7.2 per cent clearly showed this defect.

2. All departments and counters dispensing colored fabrics, with the possible exception of silks, were represented by color-blind salesmen many of whom must constitute unknown but probably serious liabilities to their employers.

3. No cases were discovered where color-blindness was being consciously used as an asset in the occupation, but it is suggested that in certain cases trials might be made to find out if such possibilities exist.

4. Regular use of the Ishihara Test at the time of employing men in mercantile establishments is recommended. Ishihara plate 5 only need be used at the original interview. Those found to have color defect should not be placed where this lack will frequently cause confusion or embarrassment to customers or to themselves.

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Achievement in College and in Later Life

By T. A. Langlie and Ashton Eldredge, *Wesleyan University*

Achievement of college men after graduation is in some degree predictable from their college scholarship and also from their prominence in student activities. Among Wesleyan alumni, scholarship is the better index.

This study was undertaken to determine the relation between scholastic or extra-curricular achievement and vocational success of Wesleyan University alumni. The three highest and the three lowest ranking men in scholarship and in activities of the twenty classes, 1897–1916, were selected. Ratings of their vocational achievements were obtained from twenty-five of their classmates. These ratings then were compared with their achievements while undergraduates and the following conclusions drawn:

1. Scholastic and extra-curricular achievement are not related to a marked extent, though good scholars do achieve more along other lines, on the average, than poor scholars. 2. The most successful group, according to ratings, is the high scholarship group, followed by the high extra-curricular achievement group. 3. The least successful group is the low extra-curricular achievement group. 4. Differences in scholastic achievement or in extra-curricular achievement are correlated to a marked extent with vocational achievement. The subjects studied were extreme cases, however, so the above conclusions must be interpreted accordingly.

INTRODUCTION

THERE has been much discussion in recent years about the relationship between college achievement and later success. One of the most comprehensive studies of this problem has been reported by the American Telephone and Telegraph Company,[1] showing that scholastic success in college is related positively to business success as measured by salaries obtained with that company. They also revealed a similar but less positive relationship between extra-curricular achievement and business success.

The answer to this question of relationship between college and business success is important for prospective employers, for college students and faculties, and for society in general, since it may emphasize the importance of our colleges for later life, or it may illustrate the invariability of individual achievement from

[1] W. S. Gifford, Does Business Want Scholars? *Harpers Magazine*, May 1928.

Donald A. Bridgman, Success in College and Business, Personnel Journal, June 1930, vol. ix, no. 1.

youth to middle age. If a true relationship is found to exist we are faced with further problems of interpretation and selection of causal factors. We may conclude that success in business is due to college training or we may conclude that success in business and in college is due to the capacities, interests, and character of the individual. The writer favors the latter interpretation and thereby emphasizes the need for early development of interests, character, habits of work, and objective self analysis to determine lines of future endeavor. Such a deterministic point of view obviously has wide social, educational, and vocational implications. But before any further discussion of interpretation takes place it is necessary to determine more definitely what relationship does exist between college and business achievement.

This study is the third of its kind to be conducted with Wesleyan alumni as subjects. Nicolson,[2] in 1915, studied the relationship between scholastic success and inclusion in *Who's Who*, reporting positive results. Landis and Thornhill,[3] in 1928, compared extra-curricular achievement in college with inclusion in *Who's Who*, with negative results. The present study compares both scholastic achievement and extra-curricular activities with later success, not as determined by inclusion in *Who's Who*, but as rated by other Wesleyan alumni.

[2] F. W. Nicolson, Success in College and in After Life. *School and Society*, August 15, 1915.

[3] R. E. Thornhill and Carney Landis, Extra-Curricular Activity and Success. *School and Society*, July 28, 1928.

METHOD

Members of the graduating classes of 1897 to 1916 inclusive were divided into four groups to correspond with their achievements in college. These groups were composed of: (1) the three men in each class with highest scholastic averages; (2) the three men in each class with lowest scholastic averages; (3) the three men in each class who had been most active in extra-curricular work; and (4) the three men in each class who had been least active in extra-curricular work. Scholarship was determined by inspection of the college office records and extra-curricular achievement by records found in the college year books for these classes.

This list of 240 names was then submitted to the twenty class secretaries representing the twenty classes and to five other alumni who were chosen because of their familiarity with the graduates of the college. These judges were requested to rate each man according to his success, which was defined as "relative degree of achievement in the field in which the individual was engaged." Four classifications were requested from each rater, namely: 1. successful; 2. average; 3. unsuccessful; and 4. unknown. Ratings were obtained for almost all of the subjects from at least one judge, and in most cases from seven to ten judges. This study compares these ratings of vocational achievement with indices of scholastic and extra-curricular success.

RESULTS

Table 1 presents the number of subjects in each category with the mean

and probable error of each distribution of measures.

Scholarship is represented by numbers ranging from 1 to 6, 1 being the highest grade and 6 being the lowest. Extra-curricular activities (E.C.A.) is represented by arbitrary weights from 1 to 10 which were assigned to each kind of activity and totalled.

Obviously, the different groups are with respect to their scholarship. Table 2 presents the results of this analysis.

According to these figures it appears that selecting two groups on the basis of extra-curricular achievements does not result in having groups who differ in scholastic averages, but when they are selected according to their scholarship they are also selected somewhat

TABLE 1

Measures of central tendency and variability of the groups

GROUP	N	MEAN	P.E.	RANGE
High scholarship	57	1.28	.13	1.00– 1.99
Low scholarship	57	3.66	.06	3.10– 4.70
High E.C.A.	60	91.77	15.10	48.00–149.00
Low E.C.A.	57	1.49	.73	.00– 3.00

TABLE 2

Measures of central tendency and variability of the groups in scholarship and activities

GROUP	N	MEAN	MEDIAN	PROBABLE ERROR	SEMI-INTER-QUARTILE RANGE
Scholarship index					
High E.C.A.	60	2.61	2.76	.55	.70
Low E.C.A.	57	2.67	2.70	.49	.48
Activities index					
High scholarship	57	26.98	21.77	24.07	9.74
Low scholarship	57	29.23	13.50	21.17	21.58

quite distinct from each other in terms of scholarship on the one hand, and activities on the other. There is no overlapping.

These groups were next studied to determine whether our methods of selection had influenced each group in other respects. The two scholarship groups were compared according to their extra-curricular achievements and the E.C.A. groups were compared according to their activities. The distributions of activities indices are markedly skewed as shown by the differences between means and medians, and the low scholarship group is scattered over the activities scale to a considerably greater extent than is the high scholarship group. Furthermore, the good scholars participated in activities to a greater extent, on the average, than the poor scholars. It

seems probable that some of the poor scholars were in that category because of too much participation in activities. Nevertheless, the two scholarship groups are much more discreet in scholarship than in activities indices.

The opposing groups were finally compared according to their vocational success or failure. The ratings that were obtained were given numerical values in order to average and compare different ratings. A rating of "successful" was given a value of 5; a rating of "average" was weighted 3; and "unsuccessful" was valued at 1. Table 3 presents measures of central tendency and variability of these ratings for the various groups.

Medians are used to represent central tendency because all of the distributions are markedly skewed. The High Scholarship group is easily the most "successful" group with the High E.C.A. group next. The "low" groups are almost equal, with a slight margin in favor of the Low Scholarship group. The "high" groups scatter more than the "low," but more than 75 per cent of the good scholars were rated as "average" or better. The most active men were rated in a similar manner, but with more "average" instead of "successful" ratings.

There is very little overlapping in these distributions. 89.5 per cent of the good scholars equal or exceed the median poor scholar, and 97 per cent of them equal or exceed the median inactive man. The median inactive man is exceeded by 96.4 per cent of the active men, and 83.3 per cent of the latter equal or exceed the median poor scholar. These and other measures of overlapping are presented in table 4.

The figures presented are definite

TABLE 3

Medians, quartiles, semi-interquartile ranges, and measures of skewness of the groups in rated vocational success

GROUP	N	MEDIAN	Q_3	Q_1	S.I.Q.	$\frac{Q_3 - Md}{Md - Q_1}$
High scholarship	57	4.35	4.91	3.08	.92	.442
Low scholarship	57	2.91	3.05	2.04	.51	.165
High E.C.A.	60	3.56	4.70	2.96	.87	1.912
Low E.C.A.	57	2.33	3.03	1.51	.76	.843

TABLE 4

Per cent of each group which equals or exceeds median scores of the other groups

	HIGH SCHOLARSHIP	LOW SCHOLARSHIP	HIGH E.C.A.	LOW E.C.A.
High scholarship	—	89.5	69.4	97.1
Low scholarship	5.3	—	12.5	68.7
High E.C.A.	27.9	83.3	—	96.4
Low E.C.A.	8.3	42.1	15.3	—

evidence that the groups of Wesleyan alumni, as selected for the purposes of this study, do tend to succeed in their chosen vocations according as they have succeeded in college, whether in scholarship or extra-curricular activities. The subjects selected are, of course, extremes, and the relationship is not perfect, but the differences in rated vocational success are sufficiently marked to warrant our conclusion.

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The Development of Personality at the College-Adult Level

By R. A. Brotemarkle, *University of Pennsylvania*

From a background of rich experience in counseling college students, Dr. Brotemarkle has listed and classified the agencies operative in developing personality at the college-adult level, and related these to their functional aims.

The terms "character" and "personality" are defined and illustrated. A comprehensive analysis is made of the factors involved in college-adult personality development. The general functional aim of each factor or group of factors is presented with the hope of shedding light on the construction of programs and methods of personality development in college.

ON MY Office desk, directly before the eyes and hands of all who sit opposite me to discuss their problems, lies a pair of brass knuckles. They have become a part of my individuality in the Office—and a veritable part of my personality in human contacts with students and faculty. They are the most effective "contact" or rapport materials I have ever employed. An agitated mind and nervous hands eagerly grasp them; but, after a few seconds of toying with them, a few remarks about or around them—an object largely unknown to most visitors—an easy going course of conversation is immediately leading into the open-hearted, frank discussion of the problem at hand. But to me these brass knuckles mean much more.

First, having been surrendered in confidence by a prisoner several years ago, while undergoing an examination for a court, they are a constant reminder of the necessary frankness of all concerned in the solution and direction of personality problems of individual and social adjustment.

Second, they are a constant reminder of the relation of personality development to college education. It happened as follows. One more visitor is seated before the "brass knuckles." I am disturbed momentarily—for surely he has come to complain of some misconduct of one of our students. He is a taxi driver—rather rough looking in his dirty sheep-skin vest. Not catching his name quickly, I was intent on noting the number on his slouchy cap. "Well," says he, "if that's your game, I'll stick." And with some dexterity he reaches to a hip pocket and lays a "brass knuckle" beside the one on the desk. A crowded drawer of

loose papers had necessitated one of the "knucks" being used as a paper weight. But it was my game and placing the other "knuck" on the desk I "raised the ante." Whereupon my caller, reaching into his other hip pocket, laid down his other "knuck" with "Well, I'll stick with you; what's the toss." My visitor was none other than one of our students whom I had summoned to a conference. He had been delayed by his part-time employment. Briefly this is the story. Here was a boy working in the mines; an interested friend inspires him to obtain an education, and gives him enough financial support to allow him to attend college classes, and spend the hours necessary for social development in part-time employment to keep body and soul together; and now he is a man, with a diploma stating that he has satisfactorily passed certain college courses and has a bachelor's degree, but without the personality to use the education he has attained, working in the same mines from which he had taken a vacation "to go through high school and college."

My "brass knuckles" afford me a direct rapport in my many student contacts, and ever keep in my mind the basic relationship between education and personality, the development of a personality which can employ an education in the social order of our day. And this is the beginning and the end of the development of personality at the college-adult level—if not all education.

The curricula content of college courses and the instruction in the class room we must leave to the Faculty; ours is the task of relating the product of collegiate education to personality. This is the greatest engineering task of human kind, the construction and employment of human character in an integrated personality. Dr. Lightner Witmer, Director of the Psychological Clinic at the University of Pennsylvania, has given us a new term; he has recently called such work "personeering." In his analysis of the problem of human conduct he has emphasized the "corrective," "preventative," "directive" and "creative" phases in the "production of the preferred patterns of human behavior" or personality.

Words like "character" and "personality" have been too loosely bandied about of late; we must emphasize some scientific foundation of their meaning. The human individual begins life as a "human organism," passes through a genetic development of "congenital potentialities" and acquired "conduct habituations," constantly presenting to all other individuals, as to himself, the momentary product of an organized system of character traits, integrated in a functioning personality. The general integrated reactions of his life mark him off from the animals and things about him as a "human personality;" his "individual responses" mark him off from other humans as a discrete "individual."

The college entrant arrives on the campus a product of the character education and personality development through which he has passed in approximately seventeen or eighteen years of activity in a home and a series of schools, amidst the myriad influences of our present day complex social order and numerous community agen-

cies. What we mean by his character is our estimate or general rating of his tendencies, habits and attitudes occurring in an oft-repeated form of conduct in any specific phase of performance. These character traits may easily be subsumed under four general headings. We will observe certain physical traits which are clearly indicated in the "skills" which he has attained in the use of the body in the performance of his daily tasks. He is vivacious and exercises a high degree of coördinated control over his physical activities. We will observe certain characteristic traits of intellect or mental response to the many stimuli about him. He is observing and quick to understand the relationships of intelligent ideas. We will observe certain Temperament traits or firmly fixed emotional responses to the situations in which he finds himself. He is cheerful or despondent, frivolous or zealous, cowardly or courageous. We will observe certain character traits of moral response to the problems involved in his social contacts. He is friendly, loyal, and compassionate, or sullen, antagonistic and supercilious.

And he is all of these things because of his nature and the character education through which he has passed. Character education is the training of the individual in the quality and degree of the various complex character traits. It aims to consolidate the reaction attitudes into a definite "set" or attitude of character.

And as for his personality—have we not been discussing already its very foundations? Personality is our estimate or general rating of the individual in his entire performance. It denotes the quality and degree of his development taken as a whole. In life, and even in the experimental situations of the psychological laboratory, we are faced with the fact that we cannot observe the individual personality functioning solely in physical, mental, emotional or social units—but always as an integrated whole. Our analysis of details of specific character traits in certain phases of human performance are meaningless until related to the synthetic function of an integrated personality.

And the individual is all of this because of the development through which his personality has passed. Personality development is the growth of the individual in the quality and degree of various personality traits. It aims to permit the integrated reaction "set" or attitude to express itself through the individuality of the person.

We should consider personality then as the sum total of all the biological innate dispositions, impulses, tendencies, appetites and instincts, and all of the acquired dispositions and tendencies in an integration of character.

Our program and methods of personality development will necessarily be determined by the specific problem at hand. We will find it necessary to adapt ourselves to varying points-of-view—as to whether we are correcting defects or developing capacities, laying down a preventative background to insure against deviation from the presently accepted patterns of preferred performance, or encouraging the unfolding of an individually created perfection of superior activity.

The myriad activities of personality development in colleges have long been

a subject of heated discussion, only lately of more scientific investigation. The trend of this investigation has recently been indicated by a "Bibliography on Methods for Personal Development of College Students" by Grace E. Manson, in the Educational Record, Supplement, No. 9, January, 1930, of the American Council on Education. Of the 275 items 75 were chosen for annotation because of their "recency" and "pertinency." A survey of the latter will show the emphasis in recent investigations in the field. Forty-five of the 75 manuscripts referred to are bibliographies, programs, surveys, summaries of the present trends, theory or the combination of these approaches. The 30 manuscripts which report scientific investigations are based largely on concrete experimental methods, only 8 being carried on under the questionnaire method. They reveal that a definite emphasis is being placed on the "study" problem. Ten articles refer to "how to study" or other study problems. The other experimental articles investigated the following factors: Honesty 4, Instruction 2, Character and Personality 2, Faculty 2, Personnel 1, and Mental Hygiene 1.

An intimate knowledge of the literature would reveal that there has been too great an emphasis on the programs and methods of personality development of college students without a very thorough analysis of the numerous factors involved or an understanding of the functional process of these complex factors. It is my purpose to attempt such an analysis at this point.

FACTORS IN DEVELOPMENT OF PERSONALITY OF THE COLLEGE-ADULT

The development of personality at the college-adult level is secured by five specific contacts. The first and last of these might readily be said to be outside of the immediate contacts of the age level which we are discussing, but are, none the less, an integral part of the entire process.

Original Contacts	Selective Process	Orientation Process	Collegiate Process	Alumni Contacts
(Antecedent Period)	(The College-Adult Period)			(Subsequent Period)

Factors in the original contacts

Individuals		—Parent
		—Alumni
		—Relative
		—Friends
		—Teachers
Groups		—Local Alumni Clubs
		—General Alumni Association
Activities	—Athletic	—Penn Relays
		—Tournaments
	—Campus	—School-Boy Day
		—School Visitation

Factors in the selective process

Admission Requirements —Intellectual —Class standing
—Examinations
—Mental —Scholastic Aptitude
—Examination
—Physical —Health certificate
—Vaccination certificate
—Character —Certificates
—Personality —Ratings

Factors in the orientation process

FRESHMAN WEEK —Administrative —Registration
—Payments
—Class admission cards
—Academic —Educational —Advising
—Regulations
—How to Study
—Study Habit Rosters
—Vocational —Pre-professional
—Informative
—Inspirational —Responsibilities
—Customs and Traditions
—Vigilance Committee
—Opening Exercises
—Social —Class get-together
—Smokers
—Luncheons
—YMCA & YWCA Camp
—Church Activities
—Religious Group Activities
—Informative —Catalogues
—Student Hand Book
—Activities —Athletics
—Library
—Publications
—Musical
—Non-athletic
—Personal —Dormitory counselors
—Upper-class counselors
—Faculty advisers and counselors
—Dean
—Personnel Officer

Factors in the collegiate process

Agency	*Functional Aim*
PHYSICAL—	
Health—	
Student Physicians	Curative Treatment
University Hospital	Curative and Corrective Treatment
Specific Case Problems	Corrective Treatment

Agency		*Functional Aim*
Hygiene—		
Lectures		Preventative Information
Quarantine		Preventative Control
Sanitation		Preventative Control
Physical Education—		
Physical Examination	—Health	Developmental Protective Information
	—Sports	Protective Guidance
Required Exercise and Swimming		Developmental Protective Exercise
Corrective Exercise	—Special	Corrective Exercise
Sports—		
Competitive —Inter-Collegiate		
	—Major Sports	Competitive Exercise—Sport
	—Minor Sports	Competitive Exercise—Sport
—Intra-Mural		
	—Inter-Fraternity	Socio-competitive Recreation
	—Inter-Departmental	Socio-competitive Recreation
	—Inter-Class	Inspirational Competitive Recreation
	—Penniman Bowl	Inspirational Competitive Reward
	—Inter-Activity	Socio-competitive Recreation
Unorganized Play—		Socio-individual Recreation
Vocational Training—		
In courses	—Laboratory	Informative Vocational Skills
	—Clinics	Informative Vocational Skills
	—Shops	Informative Vocational Skills
Military Training —		Military Preparation—Skills
CURRICULAR—		
Instructional—		
Class-room		Developmental Informative Instruction-Inspiration
Extra-class-room	—Library	Developmental Informative Instruction
	—Museum	Developmental Informative Instruction
	—Lectures	Developmental Informative Instruction
	—Research	Developmental Informative Instruction
Educational Guidance—		
Academic		Directive
Pre-professional		Directive
Vocational		Corrective-Direction
Eligibility		Preventative Control
Personal		Corrective Adjustment
Awards and Honors—		
Prizes		Inspiration—Reward
Privileges	—Unlimited cuts	Incentive —Inspiration
Yearly honors in course		Incentive —Inspiration
Graduation honors		Reward
Probation Systems—		
Academic	—Scholastic Course	Corrective Guidance
	—Conduct	Developmental Adjustment
Welfare	—Conduct	Developmental Adjustment

Agency		*Functional Aim*
Honorary Fraternities and Societies—		
Fraternities	—20	Inspiration —Reward
Societies	— 6	Inspiration —Reward
Economic—		
Scholarships		Developmental Aid
Loans		Developmental Adjustment
Self-help	—Employment	Developmental Aid
	—Placement	Developmental Guidance
EXTRA-CURRICULAR—		
Competitive Activities—		
Class activities	—Officers	Socio-political Development
Honorary Societies	—Senior 2	Socio-political Development
	—Junior 1	Socio-political Development
Managerial Offices	—Activities	Socio-executive Development
	—Clubs	Socio-executive Development
	—Publications	Socio-executive Development
	—Sports	Socio-executive Development
Publications—11		Journalistic Development
Student Council	—Government	Socio-political Development
Non-Competitive Activities—		
Fraternities and Sororities		
	—Men 91	Socio-individual Development
	—Women 22	Socio-individual Development
Class Functions	—Dances	Socio-recreation
School Functions	—Smokers	Socio-recreation
	—Luncheons	Socio-recreation
	—Rallies	Socio-inspiration
	—Founder's Day	Socio-inspiration
	—Hey Dey	Inspiration
	—Class Day	Socio-inspiration—Reward
Commencement		Inspiration—Reward
Endowment Campaign		Loyalty—Coöperation
Clubs—		
Departmental	—Chemistry 1	Information
	—History Clubs 2	Information
	—Language Clubs 5	Socio-information-Training
	—Psychology Club 1	Information
Dramatic	—Dramatic Clubs	
	—Women	Recreative-Training
	—Men	Recreative-Training
Literary	—Literary Clubs 2	Socio-informative-Training
Miscellaneous	—Aero Club 1	Information
	—Chess Club 1	Recreation
Musical	—Glee Club	Recreative-Training
	—Men	
	—Women	
	—Orchestra	Recreative-Training
	—Band	Recreative-Training
	—Mask and Wig Club	Recreative-Training
Publications	—Franklin Society	Socio-executive Development
School	—Architecture 1	Information
	—Arts Association 1	Information

Agency		*Functional Aim*
	—Dental 12	Information
	—Educational Club	
	—Women	Information
	—Men	Information
	—Engineering Clubs 3	Information
	—Fine Arts 1	Information
	—Law 9	Information
	—Medical 10	Information
	—Veterinary 1	Information
	—Wharton Association 1	Information
Sectional		Socio-development-Coöperation
Secondary School		Socio-development-Coöperation
Religious Agencies—		
Chapel		Religious Development
Christian Association		Socio-religious Development
	—Denominational Pastors 9	Religious Development
Newman Club		Socio-religious Development
	—Catholic Rectors 2	Religious Development
Jewish House		Socio-religious Development
	—Jewish Rabbi	Religious Development
Churches		
	—Designated Campus Churches	Socio-religious Development
Social Service—		
University Settlement House		Socio-development-Training
Church Agencies	—Young People's Activities	Socio-development-Training
University Centers—		
Bennett Club	—Women	Social-Recreation-Convenience
Houston Club	—Men	Social-Recreation-Convenience
Houston Hall Store		Convenience
Houston Hall Travel Bureau		Executive-Convenience
HOUSING AND LIVING—		
Residence—		
Dormitories	—Men 37	Study-Living
	—Women 1	
Fraternity & Sorority Dormitories		Study-Living
Supervised Boarding Houses		Study-Living
Meals—		
University Restaurants 2		Sustenance
Fraternities		Sustenance
Boarding Houses		Sustenance
Public Restaurants		Sustenance
Environmental—		
Climatic		Health-Work-Living
Surroundings		Health-Work-Living
City Advantages	—Theatre	Cultural-Recreation
	—Opera	Cultural-Recreation
	—Orchestra	Cultural-Recreation

Factors in the Alumni Contacts

Individuals	—Administrative Officers
	—Faculty
	—Class-mates
	—Friends
Groups	—Class Organizations
	—Departmental Organizations
	—General Alumni Association
	—Placement Bureau
Activities	—Athletics
	—Campus Publications
	—Campus and Fraternity Activities and Functions
	—University Fund
	—University Publicity

It is neither necessary nor feasible to enter into a detailed discussion of each factor we have indicated. However, it should be stated that this analysis has been based upon the activities of the University of Pennsylvania in order to make it specific. Such variations as would occur in other institutions might be used to construct a general analysis, if such is advisable. The primary purpose of such an analysis is for the specific use of separate institutions.

FUNCTIONAL AIM OF FACTORS

The functional aim of each factor is stated in a broad general scope and must be considered in light of its integrated function with all other factors at work in the given training or developmental situation.

The functional aim of the original contacts is two-fold. First, the establishing of a motivating interest; and second, the maintenance or furtherance of this interest toward the act of application for admission.

The functional aim of the selective process is at the same time individual and institutional. It purports to select the individual who will profit most in the collegiate processes of the institution, and whom the institution can depend upon for continuation of its increasing preferred performance in the changing social order.

The general functional aim of the collegiate process is developmental. It divides, under the demands of the individual case problem, into specifically developmental, corrective, preventative, directive or creative (inspirational) phases of "character education."

It is perhaps surprising to many to note that we have placed no measure of weight or emphasis on the single factors in the collegiate process. It is most surprising, I presume, that we have not given the curricular instruction of the class-room or course materials a place of decided preference. It is the specific challenge of human personality to the functioning of the college that individual differences in the "set" or attitudes of character are so variable. Where one individual is mis-informed, another is already as well informed as the class-room course instruction can hope to make him; the challenge to collegiate education is to adapt itself to the developmental

function necessary for the establishment of preferred performance on the part of each individual. This is equally true of physical health, gentlemanly demeanor, social adjustment, leadership, moral judgment or any and all other phases of personality.

The functional aim of the alumni contacts is a continuance of the developmental processes of the collegiate training. It is attained through constant emphasis upon such inspirational factors as will motivate the highest functional use of former training in the daily life of the graduate.

PROGRAM OF PERSONALITY DEVELOPMENT

In light of these myriad complex factors of personality development, what shall be said of our program for its expression? Recent studies in many representative institutions among undergraduates, graduates and faculties alike have revealed the recognition of these many important activities in the development of personality in college education. A. B. Crawford in "Incentives to Study," has revealed the relationship of many of these factors to the problem of study, concluding that, "the primary and natural incentive offered by the course of study above is evidently insufficient." And present evidence would indicate that this is as true of the motivating influences in the highly aristocratic educational structures of English colleges and prevailing democratic educational structures of American colleges, as it is of all variations or modifications of either of these structures.

The recent rapid development of the personnel system in American colleges has further emphasized the need of a coördinating liaison center of personality development. This system, under various forms, aims to make available to student and faculty alike the best possible means of adjustment for complete coördination of all factors in the development of personality. Recently, however, I have been interested in the judgment of undergraduates, graduates and faculty on the project of the establishment of a new collegiate institution. The results of the Valley Forge Questionnaire of the Committee on Educational Aspects of the Valley Forge Project at the University of Pennsylvania, coming from a typical cross-section of the Undergraduate School Family, is representative. Above all else the demand is for a training which will enable the individual "to analyse and reason clearly," develop "a broad intellectual interest" and "express and communicate one's thoughts clearly." And to secure this, along with all of the necessary educational procedures of the curricula, is the insistent demand for "a well balanced program of intercollegiate and intramural athletics, and a reasonably proportioned distribution of other student activities, such as Journalism, Executive and Managerial, Debating, Dramatic, Music, etc."

Whatever may be said for or against specific programs now in force, the ever increasing demand of all those concerned with the individual, the functioning of the college, or the product of its activity, will be that the program must be modified to carry the development of personality to the highest preferred level of performance in the social

order, and more, modified in light of the changing needs of that social order.

METHODS OF PERSONALITY DEVELOPMENT

Educational methods will apparently remain an eternal conflict between "status quo" and experimentation. The proponent of today's change is the opponent of tomorrow's. The burden of responsibility for proper training constrains even the enthusiast. Educational experiments are either complete failures or successes; and we are hesitant to accept the improved method. Perhaps we need not be greatly concerned about the changes in methods of procedure; what matters most is that the method used shall be definitely impressive and specifically effective.

The end-purpose of personality development, by whatever methods we shall employ, is the definite habituating of the individual to the "preferred patterns of performance" in the social order. And the adequacy of our methods will be measured by the individual and social adjustment of personality in the social order; while the motivating force of our method will be measured by its controlling definiteness in life activity.

Four years is a short period indeed in which the college shall continue to apply the many factors of personality development to the leaders of succeeding generations. The basic principle of education, "Learn to do by doing," urges the college on in its tremendous responsibility for four of the most valuable years of human personality development.

Manuscript received November 26, 1930

Neutralizing Inequalities in Rating

By Adelbert Ford, *University of Michigan*

The tendency to accept rating scores on employees without modification, where several different foremen are reporting scores, leads to unscientific and unfair evaluation of employees' efficiency. Inaccuracies due to differences in severity standards among raters can be corrected, as Dr. Ford shows, by determining "correction factors" for each rater, based on the characteristics of the frequency curve. A method of doing this is described in detail.

WITHOUT entering into controversy concerning the relative merits of the various methods of reporting scores in a rating scale, we wish to show here a simple method by which certain errors in rating scale scores may be neutralized. The particular method here presented is advised for any situation where two or more raters are turning in reports on the same employee and the various raters are suspected of displaying strong differences in their standards of grading. Such situations will arise in a 3-point, 5-point, 10-point, or straight percentage method of grading employees, and are very prevalent in the graphic rating scale. The method is not applicable to order-of-merit procedures.

Suppose that A and B and C are three foremen who report ratings on their men on the basis of a percentage system of scoring. A, a lenient grader whose scores all fall between 75 and 100, may give too many men the benefit of the doubt. B is a severe grader whose scores fall between 50 and 75. He has possibly an unreasonably high standard of performance. C grades the good men very high and the poor men low; his scores fall between 25 and 100—a wide distribution in many respects desirable. If these three men are handing in grades on different groups of men they may argue that their scores express real differences in ability. It will appear, however, that such wide differences between different groups is improbable and that some correction must be made. A crucial test may be made by asking the three foremen to grade the same group of men. In this case the differences in grades will appear to be due to differences in standards of grading rather than to differences in individual ability. Such a process of checking the ability of graders to keep an even standard may be accomplished when employees are moved from one foreman to another, or when a foreman is transferred from one department to another, or when two or more

supervisors know the work of the same employees. Thus we may secure several foremen's ratings on each man.

We may try to correct the differences in standards by teaching foremen how to make grades, by insisting that the average man shall have a score of 75 and that the range of scores shall be between 50 and 100. Practical foremen are usually not accustomed to clerical technicalities. Every time we make the process of grading men more complex, or hedge the activity around with qualifications of procedure we encourage lack of adequate understanding on the part of a foreman, promote disgust at typical "white-collar" methods of the personnel engineer, lower the coöperative tendency in practical men, and hasten the use of pure guessing. If adequate corrections for errors can be used in the personnel office by trained workers, we may relieve the foreman of much of the worry in making grades in such a way that the scores from one rater may be compared on an equivalent basis with the scores from another rater. We should desire a situation where equal grades from foremen A, B, and C represent men of equal ability in the traits specified in the rating scale, where scores of 90 per cent represent men equally fit for promotion no matter what foreman reported the grades. Much personnel research is lost by the necessity of waiting until the raters are sufficiently trained to produce scores which are comparable from the standpoint of severity standards, and it is doubtful if we can ever get raters so thoroughly trained that scores will be free from this error. The use of a three or five point scale of grading often merely obscures the tendency.

In grading about 350 electrical substation operators and helpers by a percentage system of scoring we found evidence of wide differences in severity standards even where the greatest patience had been exercised in giving the foremen directions for scoring. There was little difficulty in training the foremen in the subject-matter to be used in making the employee examinations, but it was almost impossible to give them an adequate understanding of the significance of a probability curve or the desirability of a distribution of marks with such a range that an employee would have an equal chance of promotion or dismissal, no matter what foreman reported the scores. We, therefore, adopted certain correction factors for the scores reported by those foremen who displayed an especially high variation from the average range of marks. A group of employees was found who had been graded by each of the foremen in question on the same examination, each man having a grade from each of the foremen.

The process of correcting the foremen's scores on their employees to neutralize differences in severity standards may be illustrated by referring to figure 1 which pictures the ratings of foremen A, B, and C cited above. All three curves represent the frequency of scores secured from the same 50 men. Since the wider distribution of foreman C seemed in many respects a desirable curve because of the fact that the extremely good employees were more completely

selected from the extremely poor employees, we used C's curve as the model. The method involves, mathematically, merely a process of transposition of A's and B's curves and their superimposition over C's curve. This

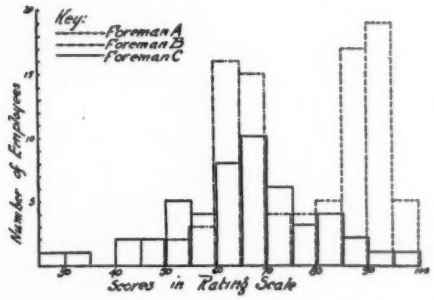

FIG. 1. DISTRIBUTION OF GRADES BEFORE CORRECTION

requires at least two distinct manipulations: (1) moving A's and B's curves along the base line in such a manner that all their *means* coincide; and (2) spreading the narrow range of A's and B's curves so that their *mean deviations* are all identical. If there were a distinct difference in skewness in the various curves we might possibly have to consider a third correction factor for this element. Such skewness, however, is not present to any great degree in the curves illustrated here.

TRANSPOSING THE MEAN

Letting M_A stand for the calculated measurement of the mean in Curve A, M_B stand for the mean of curve B, and M_C the corresponding measurement in curve C, we may derive a correction factor assuming curve C as the model on which both other curves are to be superimposed. $M_A - M_C$ becomes the difference in *average severity* between raters A and C. $M_B - M_C$ becomes the average difference in severity standards for raters B and C. The quantity $M_A - M_C$ is now subtracted from every score turned in by foreman A on every employee. In a similar way the quantity $M_B - M_C$ is subtracted from every score turned in by foreman B on every one of his employees. Although the correction factor for the *mean* was determined for all three raters on the same men, we now apply the same correction figure to new scores turned in by the same foreman, providing, of course, we dare assume that there is no change in the individual foreman's severity standards. If we have reason to believe that there is a change, we must re-test the foremen to obtain a new correction factor. The appearance of the new distribution of grades, after the *means* have been transposed, is indicated in figure 2.

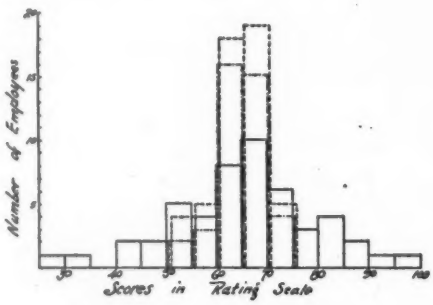

FIG. 2. DISTRIBUTION OF GRADES AFTER MEANS HAVE BEEN TRANSPOSED

It is evident that the men in the middle ranges of these curves will now be considered as equal, but there is a discrepancy at the extremes. C's poor men are still rated as worse than B's or A's men, and his good men are

rated as much better—an error due to the difference in the breadth of severity standards. In order to give A's and B's men an equal chance with C's men for promotion or discharge, we must spread their respective distributions of grades to match.

TRANSPOSING THE RANGE

If we accept some customary measurement of dispersion of a frequency curve we may adopt a correction factor for each foreman which will approximate a way of changing the grades of the employees in such a manner that we have eliminated the error of differences in the breadth of severity standards. If the *mean deviation* of A's ratings is represented by MD_A, the *mean deviation* of B's ratings by MD_B, and the corresponding measurement of C's ratings by MD_C, (the ratings having been previously corrected by the application of the above factor for differences in the mean), we may adopt $M_A \pm d\ (MD_C/_{MD_A})$, wherein d is the employees' deviation from the *mean*, as the corrected score of each of A's men. $M_B \pm d\ (MD_C/_{MD_A})$ becomes the score of each of B's men. The result of such a process on the distribution of scores is illustrated in figure

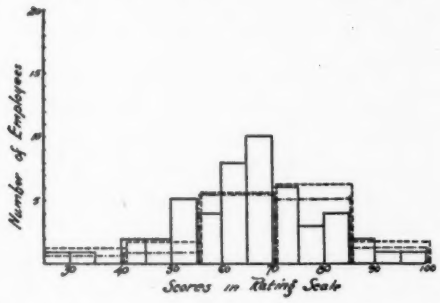

FIG. 3. DISTRIBUTION OF CORRECTED GRADES

3. From the appearance of this curve it will be evident that A's, B's, and C's employees now have an approximately equal chance of promotion or discharge. The scores of men rated by different foremen are now comparable, providing of course that the original ratings were relatively comparable.

Manuscript received June 14, 1929

Common Colds

By Wilson G. Smillie, M.D., *Harvard University*

Personnel managers in factories and large offices have asked what their recommendations to the employees should be when an epidemic of colds begins to upset the production schedule. We turned for an authoritative statement to Dr. Smillie. As the reader will see, this very expensive nuisance, the common cold, is a problem which remains unsolved. We have no practicable method of prevention and no satisfactory method of treatment.

THE common cold produces more days of illness and more loss of time from work than any other type of sickness though it is almost never a cause of death. This is particularly true of the temperate zone, less true in the tropics. The disease occurs throughout the world, from the arctic circle to the equator, but is less prevalent in the tropics, runs a milder course there and is seldom followed by severe secondary complications.

Studies by Jordan and his co-workers in college students, Sydenstricker and Collins of the U. S. Public Health Service, van Loghem in Holland and many others, have shown that in the temperate climates, the average person has about two colds a year. A few fortunate individuals never have colds, another small group has colds four or five times a year, but the great mass of the population has at least one, more probably two colds a year. This means that an attack of the disease does not confer permanent immunity, as happens in so many diseases, as for example, small pox, diphtheria, typhoid fever, measles, etc.

SEASONAL PREVALENCE

Colds are rare during the summer months. The curve of incidence rises rapidly in late October, reaching its peak about the end of the month. A drop occurs in the curve, then a second rise, which usually reaches a higher peak than the first, the highest point usually coming in the latter part of February. This curve of incidence has been noted in various parts of the United States, both north and south, and in Europe. In the tropics (West Indies) the disease as a whole is much less frequent, but the incidence curve is similar. In other words, the average person has his first cold in late October, then a period of temporary immunity for three months and a second cold in February. Thus the incidence curve of colds suggests that there is a definite relationship between changes in atmospheric temperature and the occurrence of colds.

One important factor in the produc-

tion of colds seems to be a rapid drop in atmospheric temperature. But colds are not a necessary concomitant of cold weather, as is shown by the experiences of the polar explorers. Peary, MacMillan, Byrd and other polar explorers assure us that the members of their expeditions do not suffer from colds during the severe exposure incident to their work, but frequently contract colds on first contact with the outside world. This is the story also that comes from Labrador, Spitzbergen and other isolated populations in frigid zones. One explanation of this phenomenon is that colds are a contact infection, and require a large population with rapid transportation and thus frequent contacts in order that the disease may continue to propagate itself.

DEFINITION OF COLDS

A cold is an acute inflammation of the membranes of the upper respiratory tract. It usually begins in the nose, then extends to the throat, and finally to adjacent membranes. It is usually accompanied by a feeling of weakness, headache and sometimes fever. The acute stages last two to four days. Onset is usually sudden—recovery rather slow. Secondary and sometimes serious complications may follow colds, such as infection of the ears, particularly in children, infection of the sinuses, bronchitis, and most important of all, pneumonia. There is a large group of diseases that, in the early stages, resemble colds and may be mistaken for an attack of acute cold at first, but which become clearly identified as the disease progresses. In this group are included diphtheria, scarlet fever, septic sore throat, measles, tonsillitis, as well as "hay fever" and similar conditions due to protein sensitivity.

All the diseases that have just been mentioned are readily differentiated from colds because of characteristic symptoms that soon appear, and also because in each case, we know the causal agent (except measles). Influenza, when it occurs in widespread severe epidemics, is apparently quite a distinct disease from colds. When seen in mild form, it resembles a bad cold so closely that the two diseases cannot be distinguished. Influenza and colds are so closely related that one may predict that when we have solved the riddle of the one, the other will be solved as well.

THE CAUSE OF COLDS

We do not know the causal agent of colds. The disease has been studied very extensively from two points of view:

1. The cause of colds is an infectious agent, spread by direct contact from person to person.
2. The cause of colds is a disturbance in bodily physiology, due to change in our environment, particularly a drop in atmospheric temperature, or due to exposure to drafts, and chilling of the body surface.

1. Infectious nature of colds. There is a mass of evidence which indicates that colds are due to an infection, which is spread from person to person. This unknown agent exists in the secretions of the nose and mouth of persons

who have an acute cold, but is only present for three or four days. It is spread by direct contact. The infected person develops symptoms within one or two days after exposure. This has been clearly shown in the studies of acute respiratory disease in isolated communities—South Alabama, Labrador, and the West Indies, by Smillie and his co-workers.

But bacteriological studies of these secretions from the nose and throat of persons with acute colds have been of no avail. Studies have been made by Dochez and his assistants, Noble, Smillie and Burky, and others, of the bacteria of the nose and throat of normal persons through a long period of time. During the studies, at one time or another, many of these persons have had colds. A large number of bacteria were found in the throat, either as constant or casual inhabitants, but no single type has been incriminated as the cause of the infection.

Foster filtered the nasal secretions from cases with acute colds through a Berkfeld filter, removing all the well known bacteria. He inoculated this filtrate into soldiers who volunteered for the experiment, and produced an infection in these men. Others have been unable to secure similar results and his work has been questioned. Doull and Long in Baltimore, in 1930, filtered nasal secretions from cases of colds through a Seitz filter. This filter does not permit the passage of any bacteria that we have been able to cultivate, but it does permit certain types of filterable virus to pass.

The investigators inoculated this filtrate into the nose of healthy young women who had been isolated from other people for about five days. Some of them developed colds.

These experiments offer strong evidence that colds are infectious—are spread by the secretions of the nose and throat, and are due to a filterable virus.

2. Influence of environmental factors in production of colds. The very word "colds" suggests the popular conception that the disease is due to changes in atmospheric temperature. We have already pointed out the relationship between colds and season. Van Loghem noted in Holland, that epidemics of colds follow sharp drops in temperature. Milam and Smillie made observations on colds in the tropics, where the temperature is constant throughout the year, the temperature of the coldest night seldom dropping lower than 68°F. But even under these tropical conditions, outbreaks of colds were found to coincide with sudden drop in temperature of a few degrees. Paul noted on the nonmagnetic ship "Carnegie" that the scientists and crew would be free from colds for long periods while at sea and during equable temperature, but that an epidemic occurred when the ship suddenly entered the cold Humbolt current.

Chilling of the body surface seems to predispose to colds. This may occur when those persons with a sedentary occupation are exposed to draft or when individuals sit at work all day with wet feet, or whose working place is in a cold, humid atmosphere.

We may conclude, therefore, that environmental influences play an important part in the incidence of colds

though we cannot state that colds are caused by *exposure alone.*

COMPLICATIONS OF COLDS

An acute cold is self-limited (5–7 days duration) and seldom is serious. It often paves the way for serious secondary conditions, such as infection of the antrum and other sinuses, infection of the ear, bronchitis, and pneumonia. These conditions are due to bacteria with which we are familiar. The studies of Smillie and Caldwell in Alabama showed that when persons with an acute cold exposed themselves to chilling, they often developed pneumonia. The fourth to fifth day of the cold was the critical period. It was found that *Pneumococci*, the organisms usually responsible for pneumonia, increased greatly in the throats of persons with acute colds, reaching a maximum on about the fifth day. When some of these people got thoroughly chilled by exposure to rain and winds they promptly developed pneumonia.

PREVENTION OF COLDS

No practical method for the prevention of colds has been discovered. It is almost impossible for a person in active life to avoid all contact with every person with an acute cold during the epidemic season. Invalids and infants can and should be protected, for both of these groups suffer severely from the complications of colds. Protection is obtained by prevention of contact with persons who have colds and by prevention of exposure to rapid changes in temperature.

Gargles and local disinfectants are of no proven value. We have no conclusive evidence that hardening the body by cold baths, outdoor sleeping porches and so forth has reduced the susceptibility to colds in the least. Proper ventilation, heating, and humidification probably aid in the prevention of complications of colds, particularly sinusitis. Working, living and sleeping rooms should be well ventilated, and should not be overcrowded. People working quietly should avoid drafts and the air of the workroom should have the proper temperature and humidity.

Vaccines seem to have been of value in about half of the cases in which they have been tried. In view of our present opinion as to the cause of colds, it would seem that vaccines are of little value in the prevention of the onset of the acute cold, but may be of real value in prevention of the chronic complications that may follow the acute attack.

TREATMENT OF COLDS

A person with a cold should guard against fatigue, exposure, and particularly against chilling of the body surface during the acute attack. Rest in bed during the early stages—particularly during the period when the person has fever—may prevent the development of serious consequences to the patient, and also checks the transfer of the disease to others in the community.

Most families have their own favorite home remedies for the treatment of colds. We have no evidence that these remedies influence in the least the course of the disease or cut short the duration of the illness. They do relieve some of the symptoms, make

the patient more comfortable, and other members of the family are made happy because something is being done for the patient.

SUMMARY

We do not know the cause of colds. There is strong evidence that the disease is due to an infectious organism, probably a filterable virus. We believe that this infection is spread by direct contact, from person to person. Some people are entirely immune, but most people contract the infection once or twice a year. We have strong evidence also that environmental factors, particularly an abrupt drop in atmospheric temperature, play an important part in the production of colds. The acute cold itself is self-limited in duration and seldom causes death. It is often followed by secondary complications, some of them serious. We have no specific method for the treatment or prevention of colds, except avoidance of exposure to infection. Since everyone living an active, busy life is brought into close contact with a large number of other people, it is not possible for one to avoid exposure during the epidemic seasons. The serious complications that sometimes follow an acute cold can be avoided in some instances by rest in bed and avoidance of chilling of the body surface during the acute stages of the disease.

Manuscript received December 8, 1930.

Visibility of Objects as Affected by Color and Composition of Light

Part I. With Lights of Equal Luminosity or Brightness

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For a workman to see his work clearly and without eye fatigue, the lighting must be right, and also the contrast between object and background. Drs. Ferree and Rand report a series of painstaking laboratory investigations on the color and composition of light as affecting ease and accuracy with which objects are seen.

Stimulated by a desire to discover the specifications of the ideal printed page and of other working surfaces requiring high visibility, such as license plates, signals, and reading scales of instruments, the following investigation was made. (1) The physical factors which affect the visibility of objects are analyzed. (2) Possible methods are discussed for determining experimentally the kind and comparative extent of the effect of these factors. (3) The effect of two of the factors, namely, color and composition of light, is studied. This study is made under two conditions (a) with lights of equal luminosity or brightness and (b) with lights equalized both in luminosity and saturation of color. In one set of experiments spectrum light was obtained from a large, specially designed, monochromatic illuminator, in order to have a definite and specified composition of light of a high degree of purity. In another set of experiments colored light, complex in composition, was used. It was filtered light obtained from red, yellow, green, and blue dipped bulbs, spectrophotometered for composition. This light also was equalized in luminosity and saturation at the point of work. In a third set of experiments the light used was complex in composition but of daylight quality, being obtained with Macbeth artificial daylight filter. The functions tested include acuity, speed of discrimination, power to sustain acuity, and ocular fatigue. With reference to all of these functions it was found that the eye gives its best performance in the mid-region of the spectrum, but that light of daylight quality is more favorable than any color, even when of spectrum purity, for the discrimination of such details and relations to background as are found in the printed page.

The eye apparently was not intended to work under what is ordinarily called colored light. Color in light seems to be especially trying to eyes suffering from pathological disturbances and other defects of vision.

INTRODUCTION

A SPECIAL incentive for this investigation was a request from the American Writing Paper Company, of Holyoke, Massachusetts, who in seeking for the specifications of the ideal printed page wanted to know the effect of the color of the page or other working surface on the functional powers of the eye. A further incentive has been the realization that this research might well throw light on such matters as: the comparative evaluation of lighting situations and installations; the selection of objects and the arrangement of objects and background in various industrial tasks; and the choice of combinations of object and background for certain types of test charts, for clerical forms, for signs, signals, license plates, tags, reading scales of instruments and other designations requiring high visibility.

The three most important physical factors in the visibility of objects are size of visual angle of the detail to be discriminated, difference in relation of object to background, and intensity of illumination. These factors are of course interacting in their effect on the eye. That is, changes in size will produce different changes in visibility with different relations of object to background and at different intensities of illumination. A 1-min. visual angle, for example, represents a very low visibility at a low intensity of illumination or with a small difference in coefficient of reflection between object and background, and a comparatively high visibility at a high illumination or with a large difference in coefficient of reflection between object and background. The visibilities for two values of visual angle may sustain one ratio at one intensity of illumination and relation to background and quite a different ratio at another intensity of illumination and relation to background. In short, a scale showing the relation of size of object to visibility determined for one intensity of illumination and relation to background cannot be expected to hold for other intensities of illumination and relations to background. It is not our purpose in this paper, however, to discuss in any great detail the intricacies of these interactions.

The influence of size and relation to background on the visibility of objects is in the main perhaps obvious to all, i.e., we see objects because of their size and their difference from the background. Just what part is played by intensity of illumination is, however, not so obvious. In case of an achromatic difference between object and background there seem to be two possibilities as to the influence of the intensity factor: (1) an effect on the visual or sensation difference from the background; and (2) an effect on the visual or apparent size. The first effect has been treated by us in former papers.[1] The points related to this effect may be summarized as follows. (a) With a given difference in coefficient of reflection the visual or sensation difference is greater in case of white objects on black or light objects on dark back-

[1] Intensity of light and speed of vision studied with special reference to industrial situations. Part II, *Trans. Illum. Eng. Soc.*, 1928, *23*, 507–542; Lighting and the hygiene of the eye. *Archives of Ophthalmology*, 1929, *2*, 1–26.

grounds than it is in case of black objects on white or dark objects on light backgrounds. (b) The sensation difference increases rapidly with increase of intensity of illumination.[2] And (c) the increase is more rapid for white objects on black or light objects on dark backgrounds than for black on white or dark objects on light backgrounds.

The second effect will be made the subject of a later paper. With reference to it, however, a few words may be said tentatively here. (a) There is an irradiation or spreading of the excitation aroused by the image on the retina, the amount of which is affected by the intensity or density of the light in the image. The influence of this is to increase the effective size of a detail in black on white or in dark on a light background and to decrease the effective size of a detail in white on black or in light on a dark background. And (b) an increase in the size of a luminous or illuminated area gives an effect of increase of intensity, but not in proportion to the increase in size. This action may be reciprocal, *i.e.*, an increase of intensity may give to some extent the effect of an increase in size. Such an effect, however, so far as we know, has not as yet been shown experimentally.

It is in part the purpose of the present paper to consider the effect of chromatic or hue difference between the object and its background on the visibility of the object. Three cases can be made of this problem: (a) when both object and background are colored; (b) when the object is colorless and the background is colored; and (c) when the object is colored and the background is colorless. Our study has been thus far limited to the second of these sets of conditions,—a colorless object on a colored background.

In approaching an investigation or study of the effect of any of the above factors on the visibility of objects one is confronted with the question of a measure of visibility. In conventional acuity testing, size of object or visual angle has itself been taken as the measure of visibility, and the power to see has been rated in simple inverse relation to the size of the smallest detail that can be discriminated. That is, apparently a detail subtending twice the visual angle of another detail is assumed to have twice its visibility; three times its visual angle, three times its visibility, etc. The visual angle and the visibility scale are assumed to be numerically equivalent; and power to see, or vision as it is usually called, which probably should be considered to sustain a simple inverse relation to visibility, is also considered to sustain an inverse relation to visual angle. In this connection it may also be pointed out that eyes have frequently been rated as having the same vision or

[2] There are several factors involved in this effect: (a) size of pupil; (b) difference in amount of light reflected from object and background with a given difference in coefficient of reflection; (c) the selectiveness of the sensitivity of the eye at different points in the intensity scale and the variations of this with state or stage of adaptation; (d) relation of object to background, light on dark or dark on light; etc. The net result of all the factors is that the visual or sensation difference of the object from its background increases rapidly with intensity of illumination.

power to see when the tests were conducted at very different intensities of illumination and with different relations of object to background.

Such assumptions with reference to visibility and to vision are justified of course only in case it is held that visual angle and visibility sustain to each other a 1:1 relation. Visual angle is a very important factor in visibility, but it is scarcely necessary to say at the present stage of advancement in the analytical study of the visual function that this equivalence of visual angle and visibility does not exist. As already indicated, visual angle does not even sustain a fixed relation to visibility unless the other factors affecting visibility are held constant. Even as a matter of record, therefore, any attempt at a specification of vision in terms of visual angle alone, presupposes constancy of conditions with reference to the other factors. Without this constancy the specification is not adequate for the purpose of securing reproducibility of result. A scale expressing the correct numerical relation between change in visual angle and change in visibility can not be given at the present time and perhaps can never be given with a satisfactory degree of accuracy. Comparisons can be made, however, of the ratings based on visual angle with those obtained from testing other important aspects of visibility.

With reference to the comparative effect of the three important factors: size, relation to background, and intensity of illumination on the visibility of objects, we have found that speed of seeing taken as the reciprocal of the shortest time in which the discrimination of the detail in question can be made, is a sensitive measure of visibility. The direct measure in any instance would have to be, of course, in terms of just noticeable steps or differences in visibility. The judgment required for this measure would, however, be difficult to make and the procedure in determining the steps of difference so time-consuming as to be somewhat infeasible for the many conditions or situations in which a factor may be operative. The correctness of speed as a measure, if visibility is conceived as that obtained with the optimum time of exposure, is vitiated to an extent as yet unknown by the selective action of the factors in question on the rate of rise of sensation. Considered in relation to its practical bearing, however, speed is a very important aspect of seeing and of visibility. Also, in case of the present study it has the advantage of being completely outside the group whose effects are to be compared, i.e., within the group the effect of varying any two could be compared using the third as a measure, but the effect of the third could not enter into the comparison.

To the test for speed of vision may be added two others which also have an important relation to visibility: power to sustain clear seeing, and loss of visual efficiency, or ocular fatigue. These tests are more sensitive than the test for speed of vision and like it have the advantage of being entirely outside the group whose effects are to be compared. Considered with respect to their practical bearing they also deal with very important aspects of seeing, *i.e.*, while the test for speed shows the eye's quickness of response, these latter

two tests show the power of the eye to sustain a given level of performance. In the acuity test, the size of object is taken directly as the measure of visibility and the power to see produced by a given set of conditions is rated inversely as the size of the smallest detail that can be discriminated. In the tests for speed of vision, power to sustain clear seeing, and loss of visual efficiency, size of object is considered as only one of the factors whose effect is to be measured. That measure is in terms of the eye's performance,—at least it is not measured in terms of any aspect of the stimulus or of an assumed relation between changes in this aspect and changes in the eye's response or performance.

In the direct measurement of a performance two factors are to be considered: the amount or magnitude of the performance in a unit of time and its time or duration. For an absolute measurement both of these quantities must be determined. As indicated above, the closest approximation of the measurement of the amount of visual performance is in terms of the number of just noticeable differences taken as units. The time or duration can of course be measured with comparative ease and exactness. In the tests for speed, power to sustain, and loss of efficiency through a period of work, the amount of the performance is not measured. It is taken account of, however, in the following ways. In the test for speed, the response is multiplied by the time required to give an amount which we call the threshold, or rather it is allowed to integrate through that time and the speed is taken as the inverse or reciprocal of the time. In the test for power to sustain, an amount of response which, so far as we know, is constant or approximately so, is in effect multiplied by the time for which it is given. However, since there is no direct measure of the amount of response, the time for which it is given or rather the ratio of this to the total period of observation, is taken as the measure of power to sustain. In the test for loss of efficiency this ratio is compared before and after a period of work. In all three of these tests the measure is in terms of the time for which the response is given and is therefore relative, not absolute.

In this study all of the tests discussed above, acuity, speed, power to sustain, and loss of efficiency through a period of work, have been used for the sake of what they may reveal. It is interesting to note that the order of ranking of the conditions tested, but not the amount of the effect, is the same for all the tests, with one exception. That exception will be stated later in the paper.

Some further discussion of the tests may be of interest and importance here.

In 1911 we were asked by a joint committee of the American Medical Association and the Illuminating Engineering Society to devise some means of studying the effect of lighting conditions on the eye. Finding that the acuity test as ordinarily used is not sufficiently sensitive to detect the small changes in functional condition caused by comparatively short exposures to differences in what may be called the illumination or distribution factors, we devised two ways of adding sensitivity to the test. In both of these advantage is taken of the important relation of time to powers of performance. One (speed of vision or speed of discrimination) demands the quickest possible use of the eye; the other (power to sustain) re-

quires the eye to sustain clear seeing without interruption for a period of time.

By increasing the difficulty of the task imposed on the eye both of these modifications add greatly to the sensitivity of the acuity test or any type of test based on the discrimination of detail. In addition they test functions which are of great importance to the working eye. A third modification, which we have not as yet described, may be called a test of power to sustain speed of discrimination. In this test the power to maintain any given speed of discrimination will be measured.

It is obvious that any of these tests may be used alone to compare the eye's powers of performance under different lighting conditions provided they are given a satisfactory sensitivity and reproducibility; or they may be used in connection with a period of work. In this latter case they should be applied at the beginning and end of the period and the two results be compared for changes caused by the work. We have called this latter type, a test for loss of efficiency or fatigue. In it the test for acuity, speed, power to sustain acuity, power to sustain speed or any other acceptable test may be applied before and after the period of work. Because of its superior sensitivity we have chosen thus far to use power to sustain acuity despite the care and skill required for its control. As test-objects we have used the broken circle, rotated to provide for an objective check on the judgment, for acuity and speed; and the letters "li" for power to sustain acuity and its elaboration into the test for loss of efficiency.[3]

[3] We were the first, we believe, to introduce into acuity testing the practice of rotating a single test-object sufficiently complicated in form to test acuity simultaneously in several meridians, for the purpose of imposing an objective check on the judgment. An objective check, however, could not be used in connection with the test of power to sustain acuity without causing changes in the fixedness of adjustment which would operate to relieve the strain imposed upon the eye and thus destroy the sensitivity of the test. Repeated efforts were made to use objective checks of various kinds with this test without success. Other suitable test-objects could have been employed. We have chosen these, however, because of their superior merit, after a long trial of many.[4]

The test for power to sustain clear seeing may thus be used by itself or it may be used in connection with a period of work. When used by itself, we have found it absolutely necessary to allow at least twenty to thirty minutes to elapse between two successive tests. This amount of rest is required to permit the eye to recover from the fatigue of the preceding test and to give the results a satisfactory reproducibility. Both forms of the test must also be used with an adequate control of the other factors which influence the constancy of the eye's response,—two of the most important of which are adaptation and practice. When used by itself, *i.e.*, not in connection with a period of work, all records for lighting conditions the results of which are to be compared, are made at the same sitting. This was done to avoid the effect of possible changes in the condition of the eye from day to day. When used in connection with a 3-hour reading period, however, the tests have to be made on different days. The effects of difference in conditions in the eye are minimized in this case because the change affects the initial as well as the final record with which it is compared. As a further precaution in this connection the results of any given test should be discarded unless the initial record shows the eye to have been in a satisfactory condition. This precaution has been rigorously observed in all our work. The plan of the experiments and the necessary control of factors have been fully described in previous publications.[5]

A brief analysis of factors in a lighting situation and a discussion of their relation to the functions tested may also be of interest before the consideration of the experimental work is taken up.

[4] See *Trans. I. E. S.*, 1913, *8*, p. 44; 1915, *10*, p. 412, 1125; 1920, *15*, p. 773; *Amer. Jour. Ophthal.*, 1920, *3*, p. 409.

[5] In this connection see especially *Trans. I. E. S.*, 1927, *22*, 52–75; 1913, *8*, 40–57; 1915, *10*, 1122–1130.

ACUITY

Considered with reference to the eye, there are three factors in acuity or the power of the eye to see clearly,—the resolving power of the refracting media, the space discrimination of the retina, and its sensitivity to light. To put it in another way, there are the resolving power of the refracting media or the power to form clear images on the retina, and the resolving power of the retina or the power to discriminate detail in the physical image formed.

Considered with reference to the stimulus light, six factors may be mentioned that are effective in acuity,—the *physical factors*: intensity, wave-length, and purity of light; and their three *subjective aspects*: hue, saturation, and brightness. Of these, wave-length and purity alone affect the resolving power of the refracting media or the power to form clear images. Intensity, hue, saturation and brightness affect the power to discriminate details in these images, or what we have called the resolving power of the retina. For example, the ease with which the details in a black test-object can be discriminated on a colored background varies both with the hue and saturation of the color. Moreover the factors hue and saturation are interacting. That is, the effect of hue varies with the saturation and conversely the effect of saturation varies with the hue. A part of the advantage of yellow over the other colors is doubtless in part due to its low saturation.

One is tempted to add clearness as a fourth subjective aspect of color. The test surface illuminated by blue, blue-green or red seems somewhat as if it were viewed through a solution in which some of the pigment was not dissolved but held in suspension. However, this visual murkiness is perhaps a combination of the effect of hue and saturation, and not a separate factor. In white light vision at good intensities one might almost be led to think that he is dealing directly with the physical image so clear and stable are the processes involved. In color vision the situation is different. So many phenomena occur to confuse clear seeing in color vision that one falls quite naturally into the use of such explanatory terms as the resolving power of the retina.

Wave-length affects the clearness of imaging through diffraction. Because of this phenomenon faint rings of light form about each point in the image. These rings, known as diffraction rings, overlapping neighboring points, serve to blur the image. Their breadth, or at least their effective breadth, varies directly as the wave-length of light and inversely as the aperture of the lens used. From this it follows that clearness of imaging varies inversely as the wave-length of light used and that the lens should have its highest resolving or image-forming power for the shorter wave-lengths of the spectrum.

From this it might be expected that light made up of the shorter wave-lengths would give the greatest clearness of seeing. In microscopy apparently this is true, *i.e.*, the short wave-lengths bring out with greater clearness the details in the microscopic field. While microscopy, therefore, undoubtedly serves as a good means of demonstrating or illustrating the factors which influence the resolving power of the refracting media, it is apt to be misleading or confusing as to the relative importance of these factors in vision without the microscope as an accessory. That is, in the latter case the eye views its object directly, not an image of the object formed by an accessory refract-

ing system as in microscopy. In microscopy therefore the relative importance of resolving power of the refracting system and of the factors which influence it is greatly amplified and exaggerated as compared with their importance in ordinary vision. The microscope is in fact just an amplification or extension of the eye's refracting system. It does not affect the resolving power of the retina. A discrepancy should not be surprising, therefore, between the effect of wave-length of light on acuity as is represented in the natural use and power of the eye, and in the eye whose powers are amplified by means of a microscope. In one case, it would appear, the resolving power of the retina is dominant; in the other the resolving power of the refracting system.

Purity of light affects clearness of imaging through chromatic aberration, Aberration circles form about each point in the image due to the difference in the focal length of the lens for the different wave-lengths. Clearness of imaging which depends upon the number and breadth of these circles, sustains a direct relation, therefore, to the number of wave-lengths making up the light in question and their displacement from each other in the spectrum. The influence of *composition* of light is a combination of the effects of wave-length and purity: the shorter the wave-lengths and the greater the purity, the clearer is the image formed. The effect of *hue* on the power of discrimination should be discussed in relation to the type of detail that is to be discriminated. If the detail is a black letter or other printed character, hue of light determines the quality of the background from which it must be distinguished. Some hues are apparently more favorable than others as a background for the discrimination of details in black. All hues are inferior to white in this regard. Repeated tests have shown that white is the best background on which to discriminate details in black. *Saturation* may be defined as the proportion of the chromatic to the achromatic component in the sensation. As the saturation is increased for any hue its inferiority in relation to white as a background for the discrimination of details in black is increased. *Intensity* as a factor should be discussed in relation to kind of light. In case of white light the effect of increase of intensity is to increase its luminosity or brightness. This increase in luminosity gives a greater power for clear seeing independent of sharpness of imaging. There is no doubt that up to a certain limit the power of discriminating detail in the achromatic or colorless image is greatly increased by increase of intensity. Rapid at first, the increase becomes slower as the higher intensities are reached. For colored light, however, the case is not so simple. There is a similar increase in the power of discrimination with increase of intensity through increase of luminosity, but the benefit produced by the increase in luminosity is complicated by the effect of changes in *saturation* and *hue*. These changes may become more or less favorable as the intensity is changed and add to or subtract from the power of clear seeing correspondingly. The effect of increase of intensity of light on the color sensation may be described as follows. There is an increase of luminosity which is more or less regular over small ranges of the intensity scale and this is of course a benefit. *Saturation* increases to a maximum and then decreases to zero or a very low minimum. The point of maximum saturation is reached at a comparatively low intensity and the change throughout is much less regular than the change in luminosity. Up to the point of maximum saturation, then, saturation change works against clear seeing; beyond this point the change is favorable to clear seeing. *Hue* is affected in a very complicated and irregular way by changes of intensity. A few of the hue changes for spectrum lights may be mentioned. All of the wave-lengths from red to yellow pass through yellow to white with increase of intensity beyond the point of maximum saturation. Green also passes through yellow to white with increase of intensity. All of these changes are favorable to clear seeing. At low intensities red becomes brownish; yellow, greenish; orange is tinged with greenish brown; and blue with purple. At very low intensities green is seen as blue-green or blue. These changes are in part favorable for clear seeing. In case of mixed colored light the effect of change of intensity on hue is greater in

amount and not always the same in kind. This might well be expected, because the effect of change of intensity here is not only upon the sensations aroused by the component wave-length, but also upon the physiological interactions caused by combining these wave-lengths. There seem in general to be two causes of the effect of the change of intensity on hue; an effect of the change of the achromatic on the chromatic component, similar in kind no matter how the achromatic component is changed,—by adding white light, by increasing the intensity of the light, by after-image, or by physiological induction or contrast; and an effect inherent in the process itself. This threefold effect of intensity of light on the hue, saturation and luminosity of the color sensation must be taken into account not only in matters pertaining to clear seeing by colored light but also in all colorimetric work. A hue and saturation specification of a color for one intensity of illumination is, strictly speaking, valid for that intensity alone.

The explanation for the effect of intensity, luminosity, hue and saturation on the power of discrimination of detail is given, it will be noted, in its simplest and most direct terms, that is, in terms of qualitative differences in the sensations aroused by the images formed on the retina. Details subtending the same visual angle at the eye which present the greatest difference in sensation are the most easily distinguished from each other. This is so nearly self-evident that even to state it seems tautological. That is, our only method of detecting qualitative differences in sensation is based on ease of discrimination. It may be that some other way may be found for explaining the effect of these factors on the retina's power of discrimination, but at present the data are, so far as we know, not available on which to base a different explanation. It may also be that wave-length has some other influence on the resolving power of the retina than through the sensation qualities to which it gives rise, but as yet such considerations can be only speculative.

SPEED OF DISCRIMINATION

Speed of discrimination should be affected by everything that affects acuity, and to a much greater degree than acuity is affected particularly if the time of exposure in making the acuity determination is long. In addition there is a lag in the retina's response to light and color which differs with the wave-length and intensity of light. The differential effect of this factor, however, is probably quite well masked by the other factors which affect discrimination.[6]

POWER TO SUSTAIN ACUITY

The power to sustain acuity also should be affected by everything that affects acuity. This is particularly true with regard to factors which affect the resolving power of the refracting media, *e.g.*, slight astigmatism, etc. With regard to the resolving power of the retina, however, the correspondence does not seem to be so close. For example, colored lights giving a relatively high acuity may not give an equally relatively high power to sustain acuity. As a factor in the power of the retina to sustain its resolving

[6] Observers having a slight manifest hyperopia showed a relatively greater lag of discrimination and a greater practice effect for the long wave-lengths, particularly the red; and observers slightly myopic showed a similar effect for the extreme short wave-lengths. The effect was also noticeable in the low hyperopic and myopic astigmatisms. The lag in the hyperopic meridian was relatively greater for the long wave-lengths; and the lag in the myopic meridian was relatively greater for the short wave-lengths. These are noted merely as interesting and suggestive observations. Before acceptance, they should be confirmed on a larger number of subjects.

power, the rate of decay of sensation for the different colors should be taken into account, also the phenomena which accompany decay when the retina is stimulated by colored light. For example, the streaming phenomenon which interferes greatly with the power to sustain clear discrimination seems to take place more strongly for some wave-lengths than for others, more particularly for the short wave-lengths. Green, blue, and blue-green seem especially active in producing this phenomenon. It may be stated as a general principle that the retina shows greater instability in retaining its resolving power under colored light than under white light, and that this instability is greater for some colors than for others.

ACUITY, SPEED OF DISCRIMINATION AND POWER TO SUSTAIN ACUITY AS AFFECTED BY VARIATION OF COLOR AND COMPOSITION OF LIGHT

In taking up the problem of visibility of objects and the working powers of the eye in relation to color of background, we found that it was neither practical nor feasible to work with colored papers. The control of factors needed could not be secured with colored paper without prohibitive trouble and expense. Essentially the same purpose can be served by using white paper illuminated by colored light, with a much better control of factors.

However, it is obvious that even by the use of colored light a complete separation of factors can not be accomplished. The best that can be done is to vary together certain closely related factors and hold the remainder constant. For example, wave-length, hue and saturation can be varied together and purity and photometric intensity or brightness can be held constant; hue, wave-length or composition, and purity can be varied together and saturation and brightness held constant; saturation, purity and composition can be varied and hue and brightness held constant; etc. Final conclusions as to the relative importance of factors can not be drawn from any one series of determinations. They will have to come from an intercomparison of the individual series.

This section of the paper reports the first of these sets of variations. Spectrum light was required. In using spectrum light for this purpose two possibilities are open: it can be used to illuminate a test-object seen by reflected light (the determinations being then limited to low intensities); or it can be focussed on the eye, in which case higher intensities are possible. We have chosen the first of these alternatives for the following reasons. (1) It would be difficult to make the three determinations,—acuity, speed of discrimination, and power to sustain acuity—under comparable conditions with the light focussed on the eye. (2) Because of its superior sensitivity for picking up small differences in effect and its advantages for imposing an objective check on the correctness of the judgment we wanted to use the broken circle as test-object for the work on acuity and speed. No test-

object nearly so good has as yet been devised suitable for use with light focussed on the eye. (3) We have wanted to express acuity in absolute terms or visual angle rather than in relative terms. This could not be done with any test-object known to us which could be used with the light focussed on the eye. (4) At one of the intensities used, yellow gave an average acuity slightly greater than 1, 6/6, or 20/20 for all of the observers employed. Moreover, any further increase in this intensity caused a decrease in saturation for some of the colors, *e.g.*, yellow, orange and red. That is, at the higher intensity more than half of the colors were either at or above their maximum saturation. At the lower intensity yellow was approximately at its maximum saturation; the remainder of the colors were below the maximum. It seemed allowable, perhaps advisable, therefore, to conduct one series of experiments at these intensities even though they were considerably lower than the intensities found in practical lighting situations.

The light was obtained from a minimum deviation spectroscope designed especially to give high intensities, with long collimator and objective slits and correspondingly large lenses and prism. The collimator slit was 12 mm. long. The collimator lens was a Zeiss triple achromat 18 mm. focal length, 60 mm. diameter. The prism was 100 mm. high with a face 85 mm. in length. The source of light was a well seasoned Nernst filament mounted in exact alignment with the collimator slit and as close to it as possible. The filament and the collimator slit were enclosed in a light-tight housing to exclude the light from the room. The breadth of the objective slit was 0.5 mm. The light from this slit spread directly to the test-object. The surface illuminated subtended a visual angle of 30 × 21.3 min. of arc at 6 meters. The variations of intensity were produced by varying the width of the collimator slit. The light reflected from the test surface was examined for purity with a small Hilger spectrometer furnished with an illuminated scale. No impurities above the threshold of sensation were found in any of the lights used after they had suffered reflection from the test surface.

The lights selected were narrow bands in the red (666 mμ), orange (624 mμ), yellow (578 mμ), yellow-green (563 mμ), green (522 mμ), blue-green (501 mμ), and blue (488 mμ). Two intensities of light were used 0.075 and 0.3116 f.c. (0.81 and 3.35 m.c.) designated respectively in the curves following as Intensities I and II. The lower of these two intensities was the maximum obtainable for the blue in the spectrum employed. Neither the blue nor the blue-green could be obtained at the higher intensity. The lights were made photometrically equal at these intensities. The equalization was based on the average results of two observers practiced in making the judgments of heterochromatic photometry.

ACUITY

Three observers were used in making these determinations. The work was done in a dark room. The eyes were given a 30-minute adaptation period before any observations were made. Also before the final determinations

were made for each color a practice series of 15 minutes with proper rest periods was given. The broken circle (the international test-object) mounted on a rotating dial was used as test-object. In making the judgment all that was required of the observer was to indicate the direction in which the opening pointed. The judgment on which the estimate of acuity was based was thus reduced to very simple terms and an objective check was had on its correctness. In the final series of determinations this opening was turned in haphazard order right, left, up, down, and the four 45-degree positions. The breadth of the opening was measured on a micrometer comparator and the visual angle computed. The coefficient of reflection of the test surface was 85 per cent. The pre-exposure and surrounding field were made in each case as nearly as possible of the same brightness as the test surface. An exposure of 1 sec. was allowed for each judgment. The angle of incidence of light on the test surface was kept constant throughout the experiments. Constancy of position of the observer's eye was secured by biting a mouth board in which the impression of his teeth has previously been made and hardened in wax.

Curves showing the average results for the three observers are given in figure 1, A and B. In figure 1 A acuity expressed as the reciprocal of the visual angle discriminated is plotted against wave-length. For the lower intensity the lowest acuity is found in the blue and the highest in the yellow. The ranking from highest to lowest is in the following order, yellow, yellow-green, orange, green, red, blue-green, and blue. For the higher intensity the order from highest to lowest is yellow, yellow-green, orange, green and red. At the higher intensity the acuity in

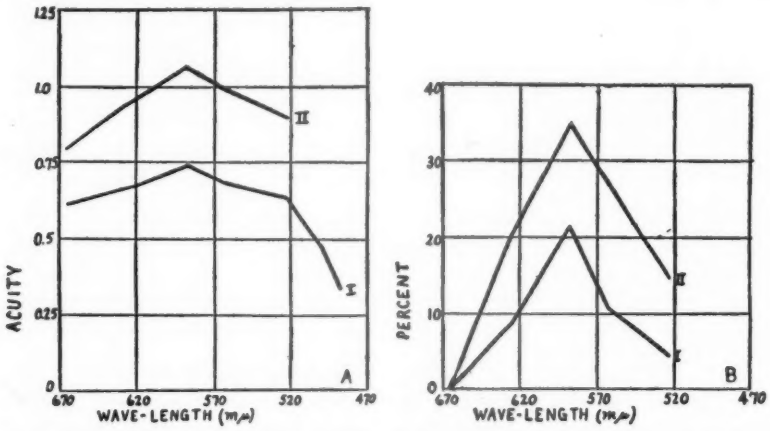

FIG. 1. SHOWING THE EFFECT OF CHANGE OF WAVE-LENGTH OF LIGHT ON ACUITY AT 0.075 AND 0.3116 FOOT-CANDLE OF LIGHT, INTENSITIES I AND II (3 OBSERVERS)

A, acuity plotted against wave-length; *B*, percentage change in acuity plotted against wave-length. The lowest value of acuity common to both curves in *A* is taken as the base on which to calculate the percentage change.

the yellow is 1.052. This is slightly greater than the Snellen norm for the emmetropic eye. The acuity for the yellow-green is approximately equal to the Snellen standard for the normal eye.

At the higher intensity the acuity was determined also for the Macbeth daylight glass transmitting the light of a Mazda type C lamp operated at 108 volts; and for the light of this lamp unfiltered. The acuity for the daylight glass was 1.125; for the Mazda lamp, 1.077, and for the yellow of the spectrum, 1.052. The comparison was not made for the lower intensity. The light transmitted by the daylight glass was a mixed light, but it had a considerable advantage for ease of discrimination over the yellow with regard to both hue and saturation. That is, the test surface illuminated by it appeared as a clear white on which the test character stood out with great clearness and distinctness. The uncorrected light of the type C lamp also suffered the disadvantage of being a mixed light but it had an advantage over the spectrum yellow in the saturation of the color component. Had the intensities been higher and the saturation of the spectrum yellow been correspondingly reduced, the result of the comparison might have been very different. As it was, however, the advantage of the spectrum yellow in homogeneity as to wave-length was more than overcome by its disadvantage in hue and saturation. Hue and saturation are very important factors in acuity. For example, the amount of color introduced into the light from the type C lamp by operating it at 90 volts gave it a lower acuity than the spectrum yellow, approximately equal to the yellow-green when the comparison was made at the lower of the two intensities.

In figure 1 B are curves showing the percentage change in acuity with change in wave-length for both intensities of light. In these curves percentage change of acuity is plotted against wave-length of light. In both cases the lowest value of acuity common to both curves in figure 1 A is taken as the base on which to calculate the percentage change. This is the acuity for red. Blue and blue-green are not represented in the curve for the higher intensity. The percentage change from red to yellow for the lower intensity was 21.4; for the higher intensity 34.7. The percentage change from blue to yellow for the lower intensity was 120.4. The change from red to yellow, it will be noted, was greater for the higher intensity. This was doubtless due to the relative change in saturation of the two colors with the increase of intensity. That is, yellow was around its maximum saturation at the lower intensity and lost saturation as the intensity was increased. This relative change in saturation will doubtless be found to be a strong factor in the relative acuities of the colors at different intensities of light. To investigate this point an intensity curve should be determined for the different colors and the shape of these curves be compared with that of the saturation curves for the colors.

SPEED OF DISCRIMINATION

These determinations were made for six observers. Again the test-object was a broken circle, the opening of which subtended a visual angle of 2.49

min. of arc at the observer's eye,—approximately the angle subtended by 10-point type at the conventional reading distance of 33 cm. The circle was mounted at the center of a graduated rotating dial. The exposures were made by means of a tachistoscope somewhat similar to that devised by us for the Air Service of the U. S. Army, furnished with only one set of exposure discs rotating in front of and as close as possible to the test-object. On the front surface of these discs in line with the observer's eye and the test-object was placed a fixation cross in order that the exposure might be given with the eye in approximate adjustment for the test-object. The reflection coefficient of the test surface was 85 per cent. The angle of incidence of light on the test surface was kept constant for all of the determinations. The work was done in a dark room. The eye was given a 30-minute adaptation period before any observations were made. Before the final determinations were made a practice series of 20 minutes, with proper rest periods, was given. In the final determinations eight positions of test-object were used,—up, down, right, left, and the four 45-degree positions.

The average results for the six observers for both intensities of light are shown in figure 2, A and B. In figure 2 A speed, expressed as the reciprocal of the time in seconds required to make the determination, is plotted against wave-length. The effect of change of wave-length on speed is much greater than on acuity, but in general the type of effect of the same. The order of rating from highest to lowest is, for the lower intensity, yellow, yellow-green, orange, green, red, blue-green and blue; and for the higher intensity yellow, yellow-green, orange, green and red.

The speed of discrimination both for

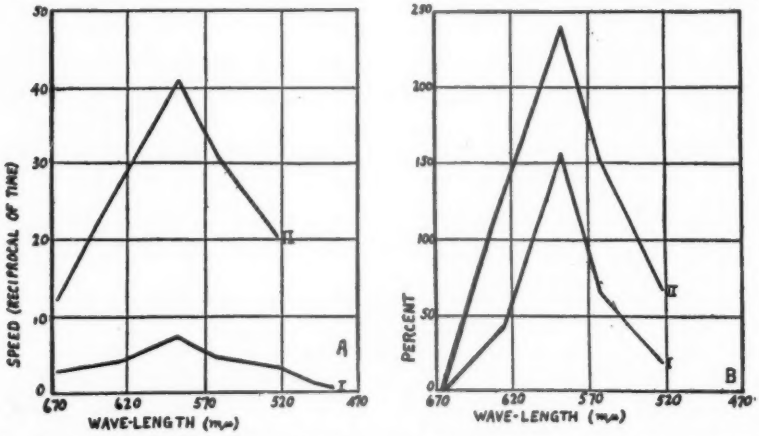

FIG. 2. SHOWING THE EFFECT OF CHANGE OF WAVE-LENGTH OF LIGHT ON SPEED OF DISCRIMINATION, INTENSITIES I AND II (6 OBSERVERS)

A, speed of discrimination plotted against wave-length; *B*, percentage change in speed of discrimination plotted against wave-length. The lowest value of speed common to both curves in *A* is taken as the base on which to calculate the percentage change.

the Macbeth daylight glass transmitting the light from a Mazda type C lamp operated at 108 volts, and the unfiltered light from this lamp, was greater than for the spectrum yellow. The speed for the daylight glass was greater than for the unfiltered light of the type C lamp. The speed for the daylight glass was 58.46; for the Mazda lamp, 48.89; and for the yellow of the spectrum, 40.87.

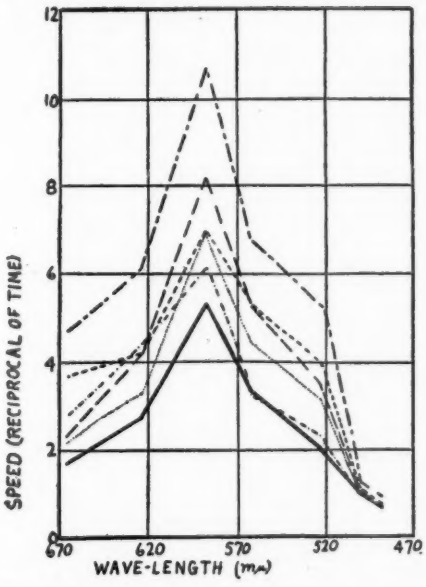

FIG. 3. THE EFFECT OF CHANGE OF WAVE-LENGTH OF LIGHT ON SPEED OF DISCRIMINATION

Showing the individual results for the six observers. Intensity I.

In figure 2 B are given curves showing the percentage change in speed with change of wave-length for both intensities of light. In these curves percentage change in speed is plotted against wave-length. In both cases the lowest value of speed which is common to both curves in figure 3 is taken as the base on which to calculate the percentage change. This is again the speed for red. Blue and blue-green are not represented in the curve for the higher intensity. The percentage change from red to yellow for the lower intensity was 155.7; for the higher intensity, 240.0. The change from red to yellow, it will be noted, was greater for the higher intensity as was the case for acuity. And as might be expected, the difference in effect, which was in all probability due to the difference in the relative saturations of the colors, was greater for speed than for acuity. The percentage change from blue to yellow for the lower intensity was 867.8.

Figure 3 gives curves showing the individual results for the six observers. The general similarity as to type of result is obvious from these curves. The chief difference is in the order of magnitude of speed.

POWER TO SUSTAIN ACUITY

For these determinations a value of visual angle was selected slightly greater than the minimum visual angle for the color giving the lowest acuity, namely, the blue for the lower intensity of light. The value of this angle was 3.664 min. of arc. The test-object was the same as we have always used for the work on power to sustain clear seeing, the printed letters "li", the task being to resolve and hold clear for a period of three minutes the break between the dot and its stem in the letter "i." The breadth of the break was 0.6255 mm. and the visual angle was subtended by the break at the observer's eye was, as already stated, 3.664 min. of arc. A record was made on a kymograph with a key, electro-

magnetic recorder, and Jacquet chronograph of the time the break could be discriminated in three minutes, the measure of the performance of the eye being expressed as a ratio of the time seen clear to the time seen blurred. It could also be expressed as a ratio of the time seen clear to the total time of observation. There being no objective check on the correctness of the judgment, its precision had to be checked up by the size of the mean variation as it is in photometry and other subjective performances in which an objective check is not possible. As in photometry, carefully tested and practiced observers are needed. The work was done in a dark room. The eye was pre-sensitized to this condition of field by a 50-minute period of adaptation. Constancy of position of the eye was secured by having the observer bite a mouth board on which the impression of his teeth had previously been made and hardened in wax. The results of these determinations are shown in figure 4, A and B. In figure 4 A the ratio of time clear to time blurred is plotted against wave-length of light. The order of ranking of power to sustain is the same as for acuity and speed of discrimination with the exception of the ranking of red and green. The acuity and speed were higher for green than for red. In case of the power to sustain the reverse was true. The eye shows better power to sustain its acuity under red light. The ranking from highest to lowest power to sustain for the lower intensity was yellow, yellow-green, orange, red, green, blue-green and blue; for the higher intensity, yellow, yellow-green, orange, red and green. In conducting the test, as has been already stated, a visual angle was selected slightly greater than the minimum for the light giving the lowest acuity. This was

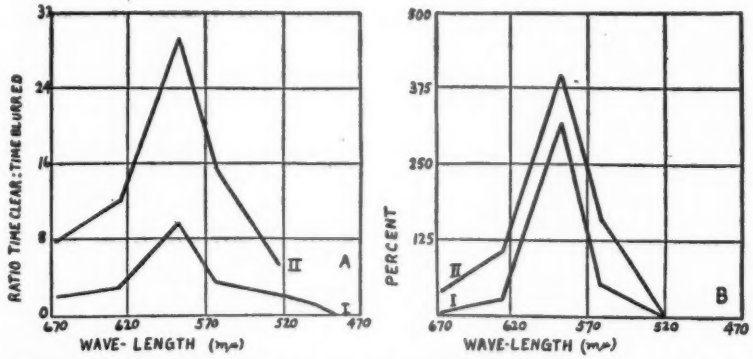

FIG. 4. SHOWING THE EFFECT OF CHANGE OF WAVE-LENGTH OF LIGHT ON THE EYE'S POWER TO SUSTAIN THE CLEAR SEEING OF THE TEST-OBJECT FOR 3 MINUTES, INTENSITIES I AND II

A, ratio time clear to time blurred plotted against wave-length; *B*, percentage change in ratio time clear to time blurred plotted against wave-length. The lowest value of power to sustain acuity common to both curves in *A* is taken as the base on which to calculate percentage change.

the blue of the spectrum of the lower intensity. Since we wanted to compare the results for the higher and the lower intensity, this angle was used also for the higher intensity. This rendered the test for the work at the higher intensity considerably less sensitive. That is, for this intensity the visual angle was too large to give maximum sensitivity to the test. It also rendered large the scale of ratios time clear to time blurred at the higher intensity.

As we have already stated, the effect of color on power to sustain acuity is very strong. This came out particularly in the comparison of the daylight glass and the Mazda type C lamp with the spectrum colors. For example, the ratio time clear to time blurred for the daylight glass was 71; for the Mazda lamp, 35; and for the yellow of the spectrum, 29.

Figure 4 B gives curves showing the percentage change in speed with change of wave-length for both intensities of light. In these curves percentage change in the ratio time clear to time blurred is plotted against wave-length. In both cases the lowest value of power to sustain which is common to both curves in figure 6 is taken as the base on which to calculate the percentage change. This is the value for green. The percentage change from green to yellow for the lower intensity was 379.5; for the higher intensity it was 475.8.

For various obvious reasons the foregoing curves showing percentage change were not all plotted to the same scale; nor was the same number of observers used throughout. In order to make possible a comparison of the effect of change in wave-length on the different functions under the conditions tested, figure 5 is given in which the curves are all plotted to the same scale and represent the results of the same observer. These curves are plotted for the lower of the two intensities. In all cases the lowest value for all the functions tested was taken as the base on which to calculate the percentage change. For the lower intensity this was the value for the blue.

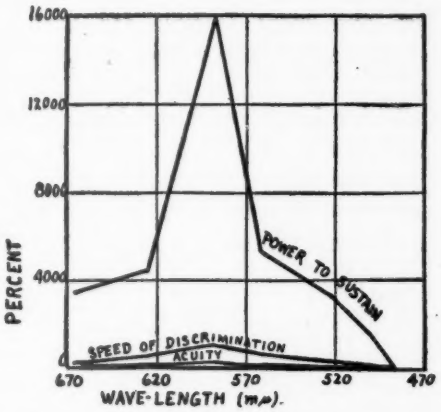

FIG. 5. SHOWING THE PERCENTAGE CHANGE WITH CHANGE OF WAVE-LENGTH OF LIGHT IN ALL OF THE FUNCTIONS TESTED, PLOTTED TO THE SAME SCALE, INTENSITY I.

The value for blue is taken as the base on which to calculate the percentage change.

An inspection of figure 5 shows that the functions most affected by change of wave-length are in order from greatest to least: the power to sustain acuity, speed of discrimination, and lastly acuity. So far as we have been able to tell from all of our work up to the present time, this order of ranking holds in general for whatever affects the functional powers of the eye:—

errors of refraction, favorableness or unfavorableness of working conditions, bodily health and fatigue, etc. From the standpoint of testing, therefore, the power to sustain acuity affords the most sensitive, and the conventional acuity test the least sensitive basis for detecting small functional disturbances in the eye, whether they be due to errors in refraction or any of the causes mentioned above. Speed of discrimination, however, is a very sensitive test and more feasible for general laboratory purposes than power to sustain.

With reference to the problem of the coloration of paper this study shows that wave-length, hue (which is a subjective aspect both of wave-length and intensity), and saturation (which is also a function of wave-length and intensity) are important factors governing the working powers of the eye. Further analysis however, is needed. Obviously an important point yet to be determined is the relative significance of hue and saturation. In other words, how much effect is there for difference in color when the working surfaces are equalized in saturation and brightness, and conversely how much effect is there for difference in saturation when hue and brightness are made equal? The first of these conditions will be treated in the next section of the paper. Spectrum lights, it may be noted, when equalized in brightness show quite large differences in saturation.

(Concluded in June number)

News Notes

PERSONNEL RESEARCH FEDERATION

ACTIVITIES OF MEMBER ORGANIZATIONS

Federal Board for Vocational Education

A Directory of Trade and Industrial Schools has recently been published by the Federal Board for Vocational Education. This publication is a complete classified directory of all trade and industrial schools and classes which were federally aided during 1929. It is arranged in two parts. In Part I the information is classified with respect to trades and subjects taught, with the States appearing in alphabetical order under each subject. In Part II the same data are given by States, each State program, classified by types of organization, appearing as a whole.

Industrial Relations Counselors

Unemployment Benefits in the United States by Bryce M. Stewart, published by the Industrial Relations Counselors, Inc., contains a comprehensive analysis of all plans for layoff compensation known to have been or now in operation in the United States up and through the year 1930. It is a factual study of the set-up of these plans, the financial and administrative problems involved, as well as of the actual experience encountered in their operation, and is based on data collected at the source.

The book is divided into two parts, the first part constituting the general discussion of the problem, its statistical phase, the function and efficacy of employment exchanges, and vocational guidance; the factor of public works, regularization by employees and attempts to control the business cycle; the development of unemployment benefit plans, their financial organization and experience; administrative procedure and experience, and legislative efforts to enact unemployment insurance. A final chapter contains a summary and general conclusions to be drawn in an attempt to evaluate the experience recorded. Part two contains a detailed analysis of each plan, embracing the administrative and financial experience, whether operated by labor unions, companies, or by employer and employees jointly. Published by Industrial Relations Counselors, Inc., 165 Broadway, New York. Price $7.50.

EXPERIMENTAL EMPLOYMENT OFFICE

The New York State Department of Labor is conducting an experimental employment office at Rochester, New York, which, according to Industrial Commissioner Frances Perkins, "will provide during a period of from three to five years a laboratory for the application of scientific methods to the problems involved in conducting a community public employment service."

Jess T. Hopkins has been appointed director of the office. He was previously personnel director of the Central Hudson Gas and Electric Corporation, with headquarters in Poughkeepsie, as well as president of the Poughkeepsie Industrial Executives' Association.

ILLNESS AMONG WAGE EARNING ADULTS

According to Dean K. Brundage in an article on "Illness Among Wage Earning Adults," concluded in the December, 1930, number of *The Journal of Industrial Hygiene*, analysis of available statistics of morbidity for sample groups of industrial workers in this country showed among other points the following:

1. During the eight years from 1921 to 1928, inclusive, respiratory diseases caused nearly one-half of all the disabilities on account of sickness. The second most im-

portant group of diseases from the standpoint of sickness frequency was the digestive disease group. The contagious and infectious diseases against which public health effort is often so largely concentrated caused only about 3 per cent of the cases.

2. Female industrial workers tend to be absent on account of illness from 50 to 100 per cent oftener than the males, the widest disparity in the rates of the two sexes being for the shorter sicknesses. Considerable difference appears to exist in the relative susceptibility of the two sexes to certain diseases.

3. Married women on the factory payroll of a large rubber company experienced considerably more disability than the single women.

4. In two studies made by the Public Health Service, the excessive use of alcoholic stimulants was found to be most pronounced among the men doing the heaviest, most disagreeable work.

5. A process of selection appears to be going on in certain industries through the quitting of those less well adapted physically to the nature of the work and the working conditions to which they were exposed. Those who tend to remain indefinitely in an industry, especially if it involves some hazard to health, represent a favorably selected group from a health standpoint.

NEW VOCATIONAL GUIDANCE DEPARTMENT

A Vocational Guidance Department has been organized in the Hecksher Foundation, New York, under the direction of Ralph Strathmore. A Bureau of Vocational Information has also been established where information may be obtained on a wide range of professions, businesses, and industries.

UNIVERSITY OF OREGON

According to *School and Society*, "All of the agencies in the University of Oregon dealing with personnel matters are now coordinated under the leadership of a dean of personnel administration responsible directly to the president. This central personnel organization includes the Bureau of Personnel Research, the offices of the dean of men and of the dean of women and the student employment offices. Outside this immediate organization but coordinated intimately with it are the following agencies, all of large significance in student welfare and guidance: (1) The personnel advisory council, a faculty committee concerned with matters of policy in the development of personnel work, (2) the health service, (3) the placement service rendered by various agencies on the campus, particularly the professional schools, (4) the student advisers, particularly the organized corps of lower division advisers, (5) other living or welfare agencies, such as the housing committee, the administrative group which supervises and regulates student housing, and (6) the various faculty committees and agencies studying problems looking toward the improvement of university service to students. The services last described, it should be understood, are all in addition to those rendered hitherto by the deans of men and women, the academic advisers, and other existing agencies, all of which continue to function substantially as before, though more closely coordinated with each other and with the agencies named above."

A GUIDE FOR AUTHORS

The editorial office of the *Personnel Journal* has on hand a supply of *A Guide for Authors in the Preparation of Manuscript*. Copies of this instructive pamphlet will be mailed on request.

FORTHCOMING MEETINGS

April 30–May 1. TAYLOR SOCIETY, SPRING MEETING. Philadelphia.

May 13–15. INDUSTRIAL CONFERENCE AT PENNSYLVANIA STATE COLLEGE. State College, Pa.

August 23–29. SECOND TRIENNIAL CONGRESS, INTERNATIONAL INDUSTRIAL RELATIONS ASSOCIATION (I. R. I.). The Hague, Holland.

September 9–17. SEVENTH INTERNATIONAL CONFERENCE OF INDUSTRIAL PSYCHOLOGY. Moscow, U. S. S. R.

PERSONAL ITEMS

DR. BEARDSLEY RUML, who served as the first Director of the Personnel Research

Federation for a few months at the time of its organization ten years ago, has been appointed Professor of Education and Dean of the newly created Social Science Division of the University of Chicago. He continues as a trustee and member of the executive committee of the Spelman Fund of New York. As director of that foundation he has been succeeded by Guy Moffett, from 1923 to 1929 a member of the federal Personnel Classification Board.

GEORGE ALAN WORKS has been appointed to a new personnel office created at the University of Chicago, that of Dean of Students and University Examiner.

V. V. ANDERSON, M.D., Director of Employment, Placement, and Personnel Research of R. H. Macy and Company, has been granted a leave of absence.

C. M. HINCKS, M.D., has become General Director of the National Committee for Mental Hygiene. He succeeds Frankwood E. Williams, M.D., as representative of that organization in the Personnel Research Federation.

Personnel Books

EDITED BY DOUGLAS FRYER

These columns include a reaction against scientific popularization. "The Marks of an Educated Man" is seen by John W. Herring as straining science a bit and "Strategy in Handling People" is criticized by John M. Brewer as a "handbook for the go-getter" rather than sound advice for the improvement of human adjustment. The contribution of science, and of psychology in particular, has never been at its best in broad practical generalizations, but rather in the detailed application of principles and methods. A sound treatment upon business management, according to Mr. Glover, comes into this issue from England and an omnibus writing on the "Science of Work" is contributed from Germany. Professor Swabey shows some interesting side-lights in the philosophy of "The Grand Old Man" of labor. "Briefer Mention" includes news from allied fields of personnel interest and "New Books" lists books published during December and January.

MR. WIGGAM PORTRAYS THE CIVILIZED MAN

THE MARKS OF AN EDUCATED MAN. By Albert Edward Wiggam. Indianapolis: Bobbs-Merrill, 1930, x + 339 pp., $3.00.

Reviewed by JOHN W. HERRING, *West Chester, Pa.*

This volume comes as a portrait of the temper of the man who wrote the Decalogue of Science. It is the temper of the evangelical preacher rather than the cool scholar. It is broad brush, brave generalization, alliterative epigram, much sound truth, and effective sentiment. It gallops down and athwart the centuries of philosophers, essayists and scientists. It betrays at every turn a veritable genius for collecting pithy and trenchant illustrative material. The book is eminently worth reading for its quotations alone. Mr. Wiggam's description of the educated man is so colorful and runs along a trail so brightly blazed that the reader may wax suspicious. He may ask himself if Mr. Wiggam isn't pushing things a bit far, carried on the crest of a phrase, when, for example, he writes that an "educated man waits until the evidence is all in" before he permits himself an opinion. The order seems a bit large, particularly when given by one whose courage is as it is in THE FRUITS OF THE FAMILY TREE.

The reader, however, will not question that the "Marks of an Educated Man" is an extraordinarily effective popularization of much convincing material. And Mr. Wiggam places himself on the side of the newer angels. If there be flaws in his thinking, or oversimplification in his classifying and captions, it is because he has enlisted so vehemently with the scientists as against

the "tight-minded" man, that he overlooks the shaded areas between white and black. He writes precisely that the line "between the open minders and the tight minders is a sharp, clean-cut, dividing line." There is that in Mr. Wiggam's confidence and resonance of style that seems faintly to beg a question here. Does truth as apprehended by the open-minded man lend itself to quite such vehement statement?

The captions of Mr. Wiggam's thought, "He cultivates the open mind," "He always listens to the man who knows," "He cultivates the habit of success," "Popular notions are always wrong," "It is never too late to learn" sound more like the title page to a certain make of American magazine than clues to the creed of an apostle of the scientific temper. This is of course the license of the popularizer. Any sugar coating will coat as well. One feels in this volume as in its predecessors that Mr. Wiggam is saying effectively to a wide audience a great many things that need wide hearing. But in setting the book down, one wonders if popularizing does not tend to defeat itself.

The volume concludes with the statement that the educated man "lives a religious life," a "religious life" consisting of a joyful relationship to a world that science enables us to understand. This is a triumphant "mark" to finish with. Only the reader wishes he shared either Mr. Wiggam's optimism about the adequacy of scientific understanding or his faith that an understood world would so surely merit a "joyful" attitude.

Mr. Wiggam has again written a book that perhaps no one else could write, combining as it does his flair for the timely, his unique collector's talent, his propagandist fervor, his vocabulary and his mental agility.

IN ENGLISH TRADITION

EDUCATION FOR BUSINESS MANAGEMENT. By James A. Bowie. London: Oxford University Press, 1930, viii + 200 pp., $3.25.

Reviewed by JOHN G. GLOVER, *New York University*

It is seldom that one has the privilege of reviewing such a well written book as Dr. J. Bowie's EDUCATION FOR BUSINESS MANAGEMENT. It is no doubt a contribution to the modern science of management; however, the principles laid down by Dr. Bowie are not new to the American student of scientific management.

This book is also a desirable contribution to the ever increasing literature in the field of industrial relations. In the first chapter, "Business Development," Dr. Bowie points out that there are not the same chances as in the past for men to use moderate amounts of capital to establish themselves in independent business enterprises, thus the individual is forced into a field of specialization. He further points out that the application of common sense and wit is no longer sufficient for the ever changing tasks, because business is becoming an exercise in constructive thought. Good management involves unity of policy, uniformity of procedure, and consistency of practice.

The chapter on "The New Responsibilities of Management" contains a wealth of valuable information for the modern business manager, because it deals with that relatively new science of handling the human element in industry. Dr. Bowie states, "If supermen are needed anywhere, it is in the sphere of business management, for when 'the captain of industry' turns from a consideration of technical equipment to questions of human management, he passes from the realm of mechanics to that of biology, and biology in its highest and most intricate form. To move freely in this realm, he needs a sound knowledge of the human sciences—sociology, physiology, and psychology—in their bearing on industrial questions. He should be as modern in his outlook and as capable in his methods as the marvellously accurate machines he installs." Then he goes on to make a sweeping but true statement which, in my opinion, sums up the nucleus of our whole industrial problem. "In the onrush of

mechanical progress the tendency has been to forget the worker and his human needs. We have established huge enterprises with national and international markets, owned by widely scattered unknown stockholders, run by a hierarchy of salaried officials, and manned by an array of machine-minders, who too often not only are, but feel themselves to be, nameless numbers on a payroll. We have denied to the worker the opportunity to express his personality in the daily work of hand and brain."

Chapter Three deals with the "Type of Leaders Needed" in our modern mechanized world, wherein the author stresses the need for students of human nature to hold the steering wheel of business and points out that management is a prodigal among professions.

Of special interest in his discussion of "Education for Management," Dr. Bowie points out that, as the average business concern is not equipped to provide the variety of experiences needed by the prospective business manager, lecturers must be recruited from within the plant. This throws the burden upon the busy executive who must now turn his thoughts to lecturing; he may be a poor talker and have very little time or energy to devote to preparation for this particular work. Under this condition, one can readily see that free discussion and criticism would hardly be possible. For this and other reasons, Dr. Bowie recommends that the Universities establish in their curricula a well rounded course in business administration. To quote Dr. Bowie, "It should be a function and obligation of our Universities to qualify the young men for achievement in every field of human endeavor which requires a high degree of ability, which is of large importance to mankind, and which can be reduced to a teachable basis. Education for management should find its place among our professional schools."

The author sets forth in a clear and concise method the objectives of a college education for prospective business executives. It should be a selector of candidates for business positions, it should train the selected students in the practices of modern business and it should cultivate in these students the ability of analysis and executive decision.

Chapter Five deals with developments in the United States of which we all are familiar. Chapter Six deals with certain peculiarities of British industry which are well worth noting in the light of our own industrial developments. The chapters on "Industrial Administration Curriculum" and "Methods of Instruction" contain a more or less typical outline of what is being already accomplished in our American Universities where business administration forms part of their curricula.

In the light of the recent demands of business executives and the present economic conditions, this book will be found extremely helpful to the student of business management. Although the book is written from an English point of view, the American reader will find that the contents represent what is already common American practice.

ANALYSIS OF EDUCATIONAL JOBS

TRENDS IN EDUCATIONAL OCCUPATIONS. By Marjorie Rankin. New York: T. C., Columbia Univ., (Cont. to Educ. No. 412), 1930, 83 pp., $1.50.

DEANS AT WORK—DISCUSSIONS BY EIGHT WOMEN DEANS OF VARIOUS PHASES OF THEIR WORK. Edited by Sarah M. Sturtevant and Harriet Hayes. New York: Harper, 1930, xii + 295 pp., $2.75.

Reviewed by KARL M. COWDERY, *Stanford University*

Education is tackling its problem of job analysis just as are industry, social work and other occupational groups. In the small volume upon TRENDS IN EDUCATIONAL OCCUPATIONS Miss Rankin presents "an examination of the waxing and waning

occupations in the public school systems of certain cities in the United States from 1898 to 1928." While primarily intended to provide data on what is involved in the educational field for young people considering teaching as a profession, the study actually performs a much wider service. Institutions which are preparing teachers may glean suggestions here as to the markets for their products. Employment and appointment services may be guided in their plans for bringing together employers and candidates for teaching, administrative and allied positions. Educational investigators may find examples of technique for estimating and evaluating present-day phases of educational history. Deans' work is without question the most intensive personnel work known in educational circles. In the book, DEANS AT WORK, eight representatives of that occupational group report the outstanding functions and methods of their operations. Previous volumes have given tables of frequency of this and that deaning method, but such job analyses have lacked the human touch and the integrating explanations which reveal how the functions, tools and organizations have met the fundamental problems of individual women in college. Here is more palatable reading in the form of first-hand accounts of what is done and why, and of the observable accomplishments. Each reporter may be "putting her best foot forward," but of such material is made up the "best practices," which, with local modifications to fit peculiar conditions, make for progress in a complicated professional field.

Dr. Rankin in her study of the evolution of education during the past thirty years has secured records from the files of ten large city school systems and four "smaller cities." The data concern 78,713 teachers representing a population area of fourteen and a half million, which, being more than ten per cent of our total population, is reported as representative of conditions in the United States. As to the representative nature of the data there seems little room to take issue if one is thinking in terms of city school systems. But inasmuch as the population of the smallest city on the list was 14,272 one is tempted to ask, what of conditions in that relatively large number of communities and school districts involving small town and rural environment? An investigation in such areas by similar methods might produce quite different results in respect to the trends reported, and equally significant ones for prospective teachers inasmuch as the smaller localities frequently absorb a large proportion of recently trained teachers.

The content of the book treats of educational occupations under five main headings, (1) maintenance, with 37 occupations; (2) personal service, comprising 44 specialized activities; (3) professional service, involving 29 positions; (4) administration and supervision, with 129 titles; and (5) the main group, the teaching force, a listing of 364 classifications by subject matter. A cross section study of educational occupations in 1928 reports representation according to these five classifications, with subdivision by educational level and the secondary school groups by teaching-subject departments. Similar groupings are used in comparing distributions for 1898, 1908, and 1918. Demand and supply of teachers are contrasted. Demand is represented by 1927–28 distributions of teachers in the 14 cities. Supply appears as the proportion of prospective teachers preparing in each subject-field in two city colleges, Teachers College of Columbia and Hunter College. The use of these two institutions, while doubtless convenient for the study, savors of provincialism when the figures purport to be representative of the whole United States. A saving feature is the brief comparison with data reported from Ohio.

The significant trends include the growth in all classifications and the proportionally rapid growths in the junior and senior high schools. In the secondary schools large numerical and percentage increases are found for English, the trades, and physical education; relative stability in most subjects and administration; but astronomy and geology have practically disappeared.

The results are decidedly significant as far as they go. Data of a more comprehensive population and reference to prob-

lems such as the rapidly growing junior college and the governmentally stimulated agricultural departments would be more completely representative of the teaching profession as a whole.

This well-written and efficiently organized report is commended to counselors, prospective teachers, training organizations, educational investigators, and placement agencies as a sample and, we hope, the fore-runner of much useful information on occupational opportunities and demands.

The analysis of the work of women deans is a study of a specialized vocation in the occupational field of education. The first two chapters, on Office Economy and the organization of "a department of student life," give modern practice and principles, which seem almost universally acceptable. Although fortunate is the dean who can equip herself in the manner recommended and can then function in a modern plant such as is described by Deans Amos of the University of Pittsburgh and Leah Boddie of the New Jersey College for Women. In discussing the physical aspects Miss Amos points out that efficient methods, carefully planned records, and convenient equipment are merely the "means to. . . .enrichment of the lives of women students." Dean Boddie then proceeds to report the actual processes of organizing the expression of ideals and principles in practice. The thread of direct contact and personality influence is seen throughout.

Marion A. Brown, Dean of Girls of the University High School of Oakland, California, shows how special forms of the same organizations, equipment and personnel can be applied to the problems of secondary school girls. Another special variation of deans' activities is demanded in such women's professional schools as the Michigan State Normal College at Ypsilanti. Dean Lydia Jones indicates that initial adjustments and continued constructive interest in broadening programs are a vital necessity.

Worthy prominence is brought to the consideration of vocational guidance problems by Iva L. Peters, Dean and Director of Personnel for Women at Syracuse University. Her thesis is that the vocational guidance function is no exception in deans' work as it calls for specialized training and is too important to be neglected or carelessly delegated. A psychologically trained dean of women may well carry this as her personal activity to serve as the hub around which will revolve many of her more traditionally recognized efforts.

The problems of the academic dean in a women's college are pointed out as involving responsibilities and authority not shared by the other deans of women. But the exposition by Dean Dorothy Stimson of Goucher College suggests that the academic dean who keeps the point of view of the "individualization of students" has little need for a separate social dean provided she has sufficient assistance to express this point of view in both instructional and living organizations.

Dean Irma Voigt of Ohio University describes the successful program of the Y. W. C. A. on and near her campus. The presentation emphasizes the fact that here is an influence for spiritual benefit with which deans may well coöperate. Dean Agnes Wells offers helpful suggestions on costs and other features of residence hall management at the University of Indiana.

The book as a whole offers attractive reading to the young woman looking forward to a possible career as a dean of women and gives many suggestions of successful practices which might be adopted for trial by deans unable to visit other colleges for first-hand observation.

A THROW-BACK IN GUIDANCE

STRATEGY IN HANDLING PEOPLE. By E. T. Webb and J. J. B. Morgan. Chicago: Boulton Pierce, 1930, vi + 260 pp., $3.00.

Reviewed by JOHN M. BREWER, *Harvard University*

This volume might well be called a handbook for the go-getter. It sets forth in the staccato style of short paragraphs and exciting incident the directions for personal success. These are not different from those in other books: gain attention through a man's special interests; be a good listener; suggest something he would like to do and let him think it is his own idea; compliment people when it will serve your interest; get acquainted with the prejudices of your man and use them to your purpose; make your man want to do what you want him to do; raise his ego; understand his objections and refute them; make his first reaction a favorable one—start him in a series of yes's; shield his vanity; praise your associates and let them have credit; size up your man every way you can, especially when he is off guard; praise a person behind his back—the most effectual kind of flattery; establish a good reputation and get it recognized; have a poker face; extract information painlessly and unconsciously, but if necessary throw up a smoke screen and do not give information yourself; bluff if necessary; don't reveal any doubts; use humor carefully; know when and how to fight; keep calm if the other man fights.

Of course, all this is not stated in this naked fashion; it is dressed up in attractive form and always with great things being done—that is, if you call great such things as landing a big contract, becoming president of the company, and making a million dollars. Yet, one wonders just what the world would be like if all boys and girls were taught these techniques.

The word 'strategy' refers directly to war, having much about it that suggests artifice and deception, and 'handling' suggests that those with whom we deal are to be manipulated to our will. The subtle effect of this book is to suggest that success is won by indirection and influence rather than by hard work. Now the writings of Samuel Smiles, bad as they are for the modern guidance of children, are full of good deeds; whereas, the modern captains of industry and politics, it appears, are full of great tricks. On page 122 the author actually tells how the German Emperor might have won the war if he had used the methods advocated in this book.

Naturally enough there are many good things in the book, particularly advice about holding one's temper, helping associates, giving credit where credit is due, and learning methods of coöperation. But the continual glorification of the methods of Napoleon, Bismarck, Mussolini, and the great fighters for industrial success in our competitive society cannot be made into a wholesome picture. If there are such things in the world of business and politics as sincerity, mutuality, affection, regard, openness, and frankness, they are not dealt with in this book. "We have no space to consider the moral aspects of building a good reputation" (p. 183).

Probably the young business man of today, on account of rapid changes which are being made in the ethics of occupational life, and on account of the spread of intelligence which makes people less susceptible to suggestion, would make a dismal failure of his life if he patterned it on the principles set forth in this volume. The vocational life which needs to be built, even while retaining its competitive features, is as far above the world described in this book as these descriptions are above the life and doings of the racketeer. If one-tenth of the energy which our great leaders of politics and industry expend in the effort to get ahead of each other were given to the solution of the problem of the business cycle who can doubt but that the social gain from this effort would be greater than which is now achieved.

GERMANY AND THE "SCIENCE OF WORK"

KÖRPER UND ARBEIT, HANDBOOK DU ARBEITSPSYCHOLOGIE. By Edgar Atzler (editor). Leipzig: Georg Thieme, Verlag, 1927, 770 pp.

Reviewed by DAVID P. BODER, *Lewis Institute, Chicago*

This volume in 8° makes a review, even if delayed, worthwhile. The fifteen articles distributed in three parts, one theoretical and two practical, present almost a complete layout of the possible angles under which the problem can be studied by the natural and technical sciences. It seems that only the social aspect is missing and this probably on purpose. One thing has to be said that although missing in the title, the fatigue aspect is emphasized all through the volume. An enumeration of chapter headings may really serve as a review. 1. Functional Anatomy (Peter). 2. Physiology of the Muscles (Riesser). 3. Sense Organs and Nervous System (Lehmann). 4. Physio-mechanical Aspect of Posture and Movement of the Human Body (du Bois-Reymond). 5. Circulation and Respiration (Mangold). 6. Metabolism and Transformation of Energy (Atzler). 7. Theory of Fatigue (Durig). 8. Physical Fitness for Work (Lehmann). 9. Racial Biology and Working Ability (Reichel). 10. Physiological Rationalization (Atzler). 11. Fatigue in Industry (Durig). 12. Nutrition of the Working Man (Lehmann). 13. Clothing of the Working Man (Herbst). 14. Sports and Work (Herbst). 15. Work and Pharmacology (Joachimoglu). The majority of chapters carry a large and up to date bibliography. The chapter on Theory of Fatigue seems to cover the field with great detail, but clearly emphasizing the shortcomings of all existing postulates.

GOMPERS THE LABOR PRAGMATIST

THE LABOR PHILOSOPHY OF SAMUEL GOMPERS. By L. S. Reed. New York: Columbia Univ. Press, 1930, viii + 190 pp., $4.00.

Reviewed by MARIE SWABEY, *New York University*

In a sense the 'labor philosophy' of Samuel Gompers was to have 'no philosophy.' Yet though he was from first to last a practical organizer and man of action rather than a leader in ideas, his common sense convictions about the world and the place of labor in it influenced the American labor movement for some fifty years. While the effect of his leadership was to steer the American Federation of Labor away from interest in ideologies, from the organization of a workers' political party, and from any far-sighted program aiming at the social control of industry, he nevertheless succeeded in establishing trade unionism on a solid basis and in achieving the immediate practical objectives of higher wages, shorter hours, and better working conditions for union members.

In calling attention to the consequences of Gompers' "trade unionism pure and simple" and his prevention of the formation of a labor party in this country, Dr. Reed makes his most interesting point; although many would challenge his further statement that "Abroad labor grows more powerful . . . .In this country the labor movement becomes more and more impotent" (p. 7). In this, on the whole, very objective and competent study, Dr. Reed traces the development of Gompers' views from his early conversion to and disaffection with socialism, through his rise to power as a trade union organizer, and his long struggle for trade autonomy and a loose federation of craft unions as against a strongly unified industrial or political unionism.

Behind Gompers' activities lay a simple

laissez faire philosophy, not unlike Herbert Spencer's. Life, he construed as a struggle for survival; and industrialism as a battle among competitive groups in the market place to drive the hardest bargain. Collective bargaining he held to be the most important weapon of the wage-earning class. Yet along with this went belief in the watchwords of individualism: liberty, independence, the right of free contract, the duty to help one's self, and let the devil take the hindmost. He himself called his view 'Voluntarism' since its main emphasis lay in the advocacy of voluntary institutions in every field of life, and in the avoidance of compulsion by the group. The success of the Federation he attributed to these principles of autonomy, voluntary association, and the independence of each union of the others.

Briefer Mention

RATIONAL ORGANIZATION AND INDUSTRIAL RELATIONS. International Industrial Relations Association. The Hague: 1930, H. Fl. 3.50, 279 pp.

The latest volume issued by the International Industrial Relations Association is a symposium of papers and other material presented at a conference held at Schloss Elmau, Kalis, Oberbayern, June 26 to July 3, 1929. This conference, coming a year later than the first Triennial Congress of the Association at Cambridge, continued the discussion there begun of human relations in the industries of the United States and Europe, but with particular attention to the adjustment of industrial relations to the conditions of scientific management. This central idea is expressed in the general topic "Human Relations in a Rationally Organized Industry."

The conference was participated in by delegates from fourteen European countries, from Australia and from the United States. Topics treated in formal papers include personnel administration in scientifically managed organizations, coöperation between labor and management, scientific determination of daily and weekly working periods, the effect of various kinds of working conditions, and the creative impulses of the workers. The concluding summary was prepared by Mary Van Kleeck of the Russell Sage Foundation, who is a vice president of the International Industrial Relations Association. The papers were originally presented in English, French or German. Translations are included in the report so that the entire proceedings are printed in the three languages.

The International Industrial Relations Association was organized at Flushing, Holland, in June 1925, with the purpose of attracting to its membership persons of various countries interested in improving the human relations in industry. Membership is individual and includes employers, personnel directors, engineers, educators, psychologists, trade union executives, and wage earners.

SPECIMEN OBJECTIVE EXAMINATIONS. By G. M. Ruch and G. A. Rice. New York: Scott, Foresman, 1930, vi + 324 pp., $1.80.

This book is an outcome of a contest sponsored by the authors in the construction of objective examinations. By objective or new-type examinations is meant those employing such devices as the completion, true-false, matching and similar types. Thirty-six of the best objective tests that were received are contained in this volume, embracing the fields of English, Social Studies, Natural Sciences, Modern Languages, Mathematics, Home Arts, Commercial Subjects and Manual Arts.

THE PSYCHOLOGY OF ACHIEVEMENT. By Walter B. Pitkin. New York: Simon and Schuster, 1930, xi + 502 pp., $3.50.

Presumably this is one of the so-called self-help books. It is something of psychology, anecdote, biography and philosbphy all rolled into one to direct thought toward the value of "achievement," which is defined as "distinguished successful endeavor, usually in the face of difficulties." Its popular appeal is evident; its intent is

realistic and heartening; its wisdom is homely, shrewd and vividly put. The author has no use for the "success cults"; he builds on more solid foundations. He studies energy, interest, emotions, and intelligence; and his psychological depiction of these qualities is distinctly contemporary. Professor Pitkin is seriously concerned to advance the effectiveness of really superior individuals in society and this book is an honest and forceful, if somewhat flamboyant, brief on their behalf. It deserves a wider academic reading than its readability will probably secure for it!

CURRICULUM PROBLEMS IN INDUSTRIAL EDUCATION. By F. C. Smith. Cambridge; Harvard Univ. Press, 1930, ix + 145 pp., $1.00.

After presenting the accepted methods of building a professional curriculum, the author proposes the elimination of the traditional job analysis made by an expert and the substitution of a "group conference method conducted with competent judges from the fields of industry, education, and organized labor." The author then describes a curriculum made in this way and reports the results secured in one industrial school. It should be remarked that the end which the author has in mind in such a course is not to create or extend manipulative skills, but to give technical and related information essential to the upgrading of the individual in his present employment.

AVIATION AS A CAREER. By J. V. Hanna. New York: Voc. Bull. No. 5, The Young Man and His Career, Kiwanis Club. 1930, 32 pp.

A small pamphlet to enlighten young men in regard to some of the opportunities in the field of aviation. Part I is devoted to "Fields of Opportunity in Aviation" with short paragraphs regarding the development of mail, passenger and express service, photography, control of insects, forest fire patrol, and other occupations in which an airplane is used. Part II is devoted to "occupations in aviation" which gives a short description of the duties and requirements of pilots, mechanics and craftsmen.

WRITING FOR PROFIT. By Donald Wilhelm. New York: McGraw-Hill, 1930, xi + 385 pp., $3.00.

Mr. Wilhelm writes with the purpose of helping the new author who has to go it alone. His emphasis is upon the practical aspects of telling and selling a story. He quotes, from many editors, vocational advice which is largely of the "uplift" variety. Here and there, however, the anxious writer may find a clue that will guide him in his orientation to the field. Chapters are devoted to newspaper work, magazine articles, syndicates, interviewing, publicity work and advertising, fiction, motion pictures and the talkies, and finally to the newest field of all, writing for the radio. The last chapter gives "a newsroom rhetoric" compiled by The Indianapolis News for its reporters. This is couched in simple language and covers many of the common difficulties faced by the writer whose "writing ear" is untrained or insensitive, and thus should be of service to most of the wielders of the typewriter.

HUMAN NATURE. By Max Schoen. New York: Harper, 1930, xviii + 481 pp., $2.50.

Psychologists have been accused of making a potentially interesting subject dry. Schoen in a fascinating manner writes this text in terms of everyday experience. Although he covers quite thoroughly the subject matter of Psychology, he probably will be accused by some of being unscholarly. This book can well be recommended to those who desire an interesting and yet scientific treatment of the subject matter of Psychology.

THE AUTOBIOGRAPHY OF A CRIMINAL. By Henry Tufts. Edited by Edmund Pearson. New York: Duffield, 1930, xvii + 357 pp., $3.

The first edition of this contribution to Americana was printed in 1807, since when the work had disappeared from sight. Edmund Pearson now revives it, with an introduction and some editorial comment, as the first life history of a criminal written in this country. Henry Tuft's criminal career seems largely distinguished by its

failures and the fruits of his activities were often bitter indeed, including a sentence for hanging which was finally remitted. We must suppose that he committed his thefts because he enjoyed the task, whether or not the result was enjoyable, and that he preferred any sort of misadventure to the continuing tedium of domestic life. His wanderings among the Indians, his performance as a deserter during the Revolutionary War, and his frequent and invariably successful encounters with various ladies cast interesting side-lights upon the folkways and beliefs of the times.

SOCIAL PSYCHOLOGY. By B. C. Ewer. New York: Macmillan, 1929, 436 pp. $2.25.

An elementary and readable exposition of the main concepts of modern social psychology. Ewer attempts to synthesize Allport and McDougall, in spite of their radical differences in viewpoint.

THE MOTIVES OF MEN. By G. A. Coe. New York: Scribner's, 1930, x + 265 pp., $1.00.

This is a republication in a dollar edition of this popular book upon human motives which was first published in 1928.

CHICAGO. AN EXPERIMENT IN SOCIAL SCIENCE RESEARCH. Edited by T. V. Smith and L. D. White. Chicago: U. of Chicago, 1929, 283 pp.

This book is a guide to all the varied social science projects which have resulted from the coöperative research organization established at the University of Chicago in 1923. Social maps of Chicago play a large rôle in recording and interpreting data, and several of these are shown in the text. A table is presented which compares two Chicago communities of about the same population. For each community there are data as to land values, numbers of stores and banks, physicians, representation in *Who's Who*, politicians, and rates of divorce, desertion, suicide, poverty and delinquency. There is a directory of publications and of unpublished studies.

REDS AND LOST WAGES. By Charles G. Wood. New York: Harper, 1930, xv + 280 pp., $4.00.

A Commissioner of Conciliation in the Department of Labor gives some of his first-hand impressions regarding the strikes he has observed during the past twenty years, with a description of the methods by which the Federal Commissioners help to settle industrial disputes. The first part of the book is devoted to the dangers of radical labor leadership; with that out of the way, the author makes useful suggestions for avoiding industrial warfare. He emphasizes the necessity of a permanent clearing house for grievances between employers and employees, either through a labor union or some other body. "What is a fair wage?" he considers to be always an arbitrable question, as are also methods of work and the conditions of work.

New Books

LABOR RELATIONS

INDUSTRIAL RELATIONS IN THE BUILDING INDUSTRY. By William Haber. Cambridge: Wertheim Fellowship Pub'ns., 1930, 612 pp., $5.00.

LABOR AND LUMBER. By Charlotte Todes. New York: Internat'l Pub., 1931, 208 pp., $2.00.

THE CHURCH AND INDUSTRY. By Spencer Miller, Jr. and J. F. Fletcher. New York: Longmans, 1930, 286 pp., $2.50.

MENTAL TESTS AND USES

INTROVERSION AND EXTROVERSION IN THE HIGH SCHOOL; THEIR RELATION TO AGE, SEX, ACADEMIC SUCCESS; AND LEADERSHIP. By R. D. Macnitt. Boston: Badger, 1930, 224 pp., $2.00.

METHODS OF CORRELATION ANALYSIS (application of statistics to research work). By Mordecai Ezekiel. New York: Wiley, 1930, 427 pp., $4.50.

TESTS AND INTEREST QUESTIONNAIRES IN

THE GUIDANCE OF HIGH SCHOOL BOYS. By P. M. Symonds. NEW YORK: T. C., Columbia Univ. Press, 1930, 69 pp., 75¢.

GUIDANCE (VOCATIONAL AND EDUCATIONAL)

GUIDING THE CHILD TO SUCCESS. By A. M. Emley. Denver: Wm. H. Andre, 1930, 111 pp., $1.50.

GUIDING RURAL BOYS AND GIRLS; FLEXIBLE GUIDANCE PROGRAMS FOR USE BY RURAL SCHOOLS AND RELATED AGENCIES. By O. L. Hatcher. New York: McGraw-Hill, 1930, 326 pp., $2.50.

PSYCHOLOGICAL SERVICE FOR SCHOOL PROBLEMS. By Gertrude Hildreth. Yonkers: World B'k., 1930, 330 pp., $2.16.

THE GUIDANCE OF MENTAL GROWTH IN INFANT AND CHILD. By Arnold Gesell. New York: Macmillan, 1930, 333 pp., $2.25.

MENTAL HEALTH

ABNORMAL PSYCHOLOGY; ITS CONCEPTS AND THEORIES. By H. L. Hollingworth. New York: Ronald, 1930, 601 pp., $4.50.

CRIME AND DESTINY (TR. BY CHARLOTTE HALDANE). By Johannes Lange. New York: Paper B'ks., 1930, 250 pp., 50¢.

MANAGEMENT AND ADMINISTRATION

AN EARLY EXPERIMENT IN INDUSTRIAL ORGANIZATION; BEING A HISTORY OF THE FIRM OF BOULTON AND WATT, 1775–1805. By Erich Roll. New York: Longmans, 1930, 336 pp., $5.00.

BANKING THEORY AND PRACTICE. By Luther Harr and W. C. Harris. New York: McGraw-Hill, 1930, 570 pp., $4.00.

BUSINESS LETTERS: THEIR PREPARATION AND USE. By H. A. Burd and C. J. Miller. New York: McGraw-Hill, 1930, 512 pp., $4.00.

DEPARTMENT STORES; RECENT POLICIES, COSTS AND PROFITS. By Emmet Boris. Stanford: Stanford U. Press, 1930, 237 pp., $4.00.

INDUSTRIAL EVOLUTION. By N. S. B. Gras. Cambridge: Harvard U. Press, 1930, 259 pp., $2.50.

PROFITABLE DEPARTMENT STORE MANAGEMENT (introd. by Philip Le Boutillier). H. W. Schacter. New York: Harper, 1930, 219 pp., $4.00.

SCHOOL PRESS MANAGEMENT AND STYLE. By Lambert Greenawalt. New York: McGraw-Hill, 1930, 420 pp., $3.00.

THE ART OF BUSINESS REASONING. By H. G. Schnackel. New York: Wiley, 1930, 320 pp., $3.50.

THE RETAIL EXECUTIVE; HIS PREPARATION AND TRAINING. By Thorndike Deland and E. A. Raisbeck, Jr. New York: Harper, 1930, 218 pp., $3.00.

VOLUNTARY CHAIN STORES, AND HOW TO RUN THEM. By Craig Davidson. New York: Harper, 1930, 361 pp., $5.00.

ADVERTISING AND PUBLICITY

COPY TECHNIQUE IN ADVERTISING. By Richard Surrey. New York: McGraw-Hill, 1930, 297 pp., $4.00.

MODERN ADVERTISING ART (FOREWORD BY E. E. CALKINS). By Frank H. Young. New York: Covici, Friede, 1930, 199 pp., $7.50.

PROBLEMS IN RETAIL DISTRIBUTION. By N. P. McNair and C. I. Gragg. New York: McGraw-Hill, 1930, 557 pp., $5.00.

TYPOGRAPHIC DESIGN IN ADVERTISING. By L. B. Siegfried. Wash.: United Typothetae of Amer., 1930, 128 pp., $2.25.

WHO'S WHO IN ADVERTISING, 1931. By J. L. Rogers, ed. New York: Harper, 1931, 300 pp., $7.50.

SOCIAL WORK

A CHANGING PSYCHOLOGY IN SOCIAL CASE WORK. By V. P. Robinson. Chapel Hill: U. of N. C., 1930, 221 pp., $2.50.

VOCATIONAL INFORMATION

EXPERIMENTAL ELECTRICITY. By R. H. Walters. New York: McGraw-Hill, 1930, 145 pp., $1.50.

PRINTERS' MARKS AND THEIR SIGNIFICANCE. By D. C. McMurtrie. Chicago: Eyncourt, 1931, 29 pp., $1.25.

PUBLISHING AND BOOKSELLING; A HISTORY FROM THE EARLIEST TIMES TO THE PRESENT DAY; WITH A BIBLIOGRAPHY BY W. H. PEET. By F. A. Mumby. New York: Bowker, 1931, 480 pp., $6.00.

TEACHING THE USE OF BOOKS AND LIBRARIES; A MANUAL FOR SCHOOL LIBRARIANS AND CLASSROOM TEACHERS, TO ACCOMPANY THE LIBRARY KEY. By May Ingles and Anna McCague. New York: Wilson, 1930, 198 pp., $1.80.

THE BUSINESS OF WRITING. By F. W. Ziv. Cincinnati: Writer's Digest, 1930, $2.00.

THE FUTURE OF FARMING. By C. S. Orwin. New York: Oxford, 1930, 160 pp., $2.00.

THE HOUSE OF MORGAN; A SOCIAL BIOGRAPHY OF THE MASTERS OF MONEY. By Lewis Corey. New York: G. H. Watt, 1930, 479 pp., $5.00.

THE WORK OF THE STOCK EXCHANGE (rev. ed.) By J. E. Meeker. New York: Ronald, 1930, 736 pp., $5.00.

WORLD LEADERS. By Hazel Manley. Boston: Badger, 1930, 256 pp., $2.50.

INDUSTRIAL EDUCATION

EDUCATION FOR BUSINESS MANAGEMENT; THE CASE FOR THE FURTHER DEVELOPMENT OF EDUCATIONAL FACILITIES. By J. A. Bowie. New York: Oxford, 1930, 208 pp., $1.50.

FOUNDATIONS OF INDUSTRIAL EDUCATION. By J. C. Wright, Ed. New York: Wiley, 1930, 492 pp., $3.00.

TEACHING AGRICULTURAL VOCATIONS (2nd ed.). By R. M. Stewart and A. K. Getman. New York: Wiley, 1930, 377 pp., $3.00.

THE HEART OF DEMOCRACY (THE AMERICAN PUBLIC SCHOOLS); SANDUSKY-FORT RECOVERY ED. By James Ross. Sandusky, O.: Author, 1930, 263 pp., $2.00.

PSYCHOLOGY

EIDETIC IMAGERY, AND TYPOLOGICAL METHODS OF INVESTIGATION (TR. BY OSCAR OESER). By E. R. Jaensch. New York: Harcourt, 1930, 136 pp., $2.75.

EMOTIONS OF MEN. By F. H. Lund. New York: McGraw-Hill, 1930, 358 pp., $2.50.

INTELLECTUAL GROWTH IN YOUNG CHILDREN; WITH AN APPENDIX ON CHILDREN'S "WHY" QUESTIONS BY NATHAN ISAACS. By Susan Isaacs. New York: Harcourt, 1930, 381 pp., $4.00.

SOCIAL PSYCHOLOGY. By E. Y. Kreuger and W. C. Reckless. New York: Longmans, 1931, $3.00.

YOUR CHILD YEAR BY YEAR; A DEVELOPMENT RECORD AND GUIDE FROM BIRTH TO THE SIXTEENTH YEAR. By J. E. Anderson and F. L. Goodenough. New York: Cupples, 1930, 382 pp., $3.00.

ECONOMICS

JAPAN'S ECONOMIC POSITION; THE PROGRESS OF INDUSTRIALIZATION. By J. E. Orchard and D. J. Orchard. New York: McGraw-Hill, 1930, 520 pp., $5.00.

LABOR AND COAL. By Anna Rochester. New York: Internat'l Pub., 1931, 255 pp., $2.00.

NATIONAL AND STATE BANKS; A STUDY OF THEIR ORIGIN. By L. C. Helderman. Boston: Houghton, 1930, 188 pp., $3.00.

RUSSIA'S PRODUCTIVE SYSTEM. By Emile Burns. New York: Dutton, 1930, 288 pp., $4.00.

STABILIZATION OF THE PETROLEUM INDUSTRY. By L. M. Logan, Jr., Norman, Okla.: U. of Okla. Press, 1930, 248 pp., $2.50.

THE ECONOMIC WAR. By George Peel. New York: Macmillan, 1930, 291 pp., $4.25.

THE LAWFUL PURSUIT OF GAIN. By Max Radin. Boston: Houghton, 1931, 144 pp., $1.25.

THE RUSSIAN EXPERIMENT (TR. BY H. J. STENNING). By Arthur Feiler. New York: Harcourt, 1930, 272 pp., $2.00.

UNEMPLOYMENT INSURANCE IN GERMANY (2nd ed., rev.). By M. R. Carroll. Wash.: Brookings Inst., 1930, 137 pp., $2.50.

SOCIOLOGY

A SYSTEMATIC SOURCE BOOK IN RURAL SOCIOLOGY. By P. A. Sorokin, and others, eds. Minneapolis, U. of Minn. Press, 1930, 672 pp., Vol. I, $6.50, 3 vol. set $15.00.

LOVE, MARRIAGE AND DIVORCE, IN HISTORY AND LAW. By Judge Louis Harris. Boston: Stratford, 1930, 163 pp., $2.50.

METHODS IN SOCIAL SCIENCE; A CASE BOOK. By S. A. Rice, ed. Chicago: U. of Chic. Press, 1931, 835 pp., $4.50.

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PREPARED BY LINDA H. MORLEY, *Industrial Relations Counselors, Inc.*

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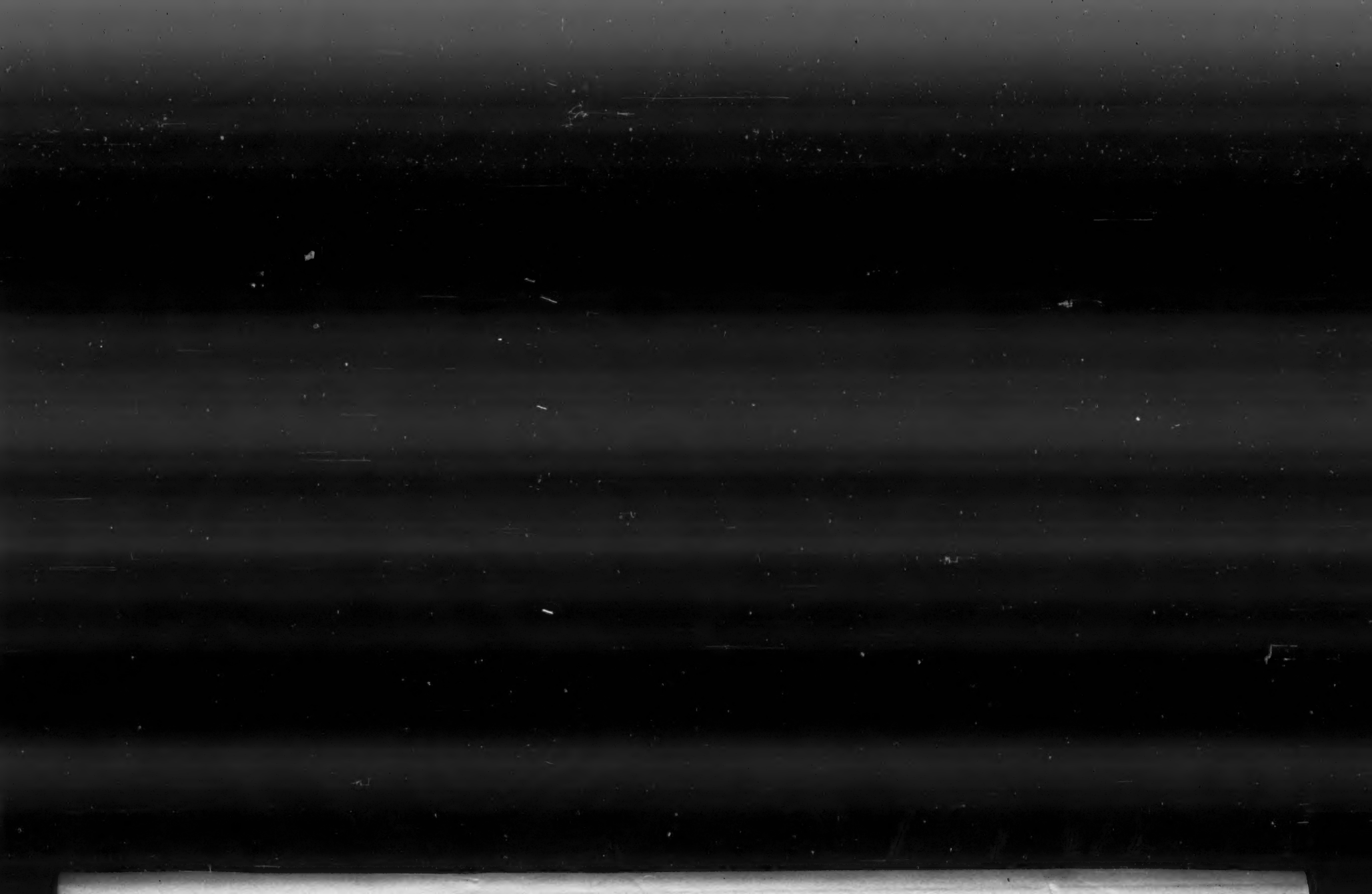

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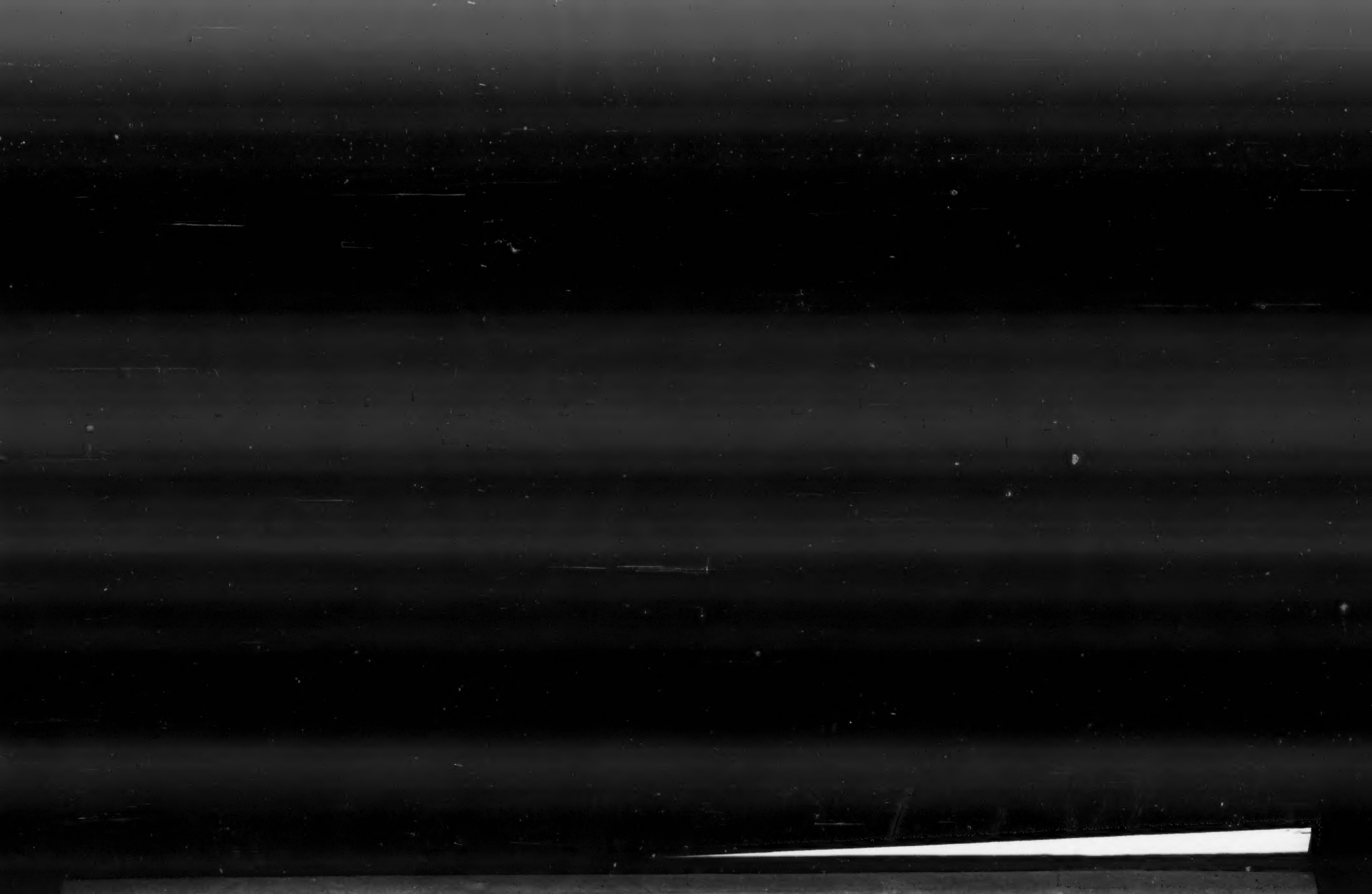
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